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MODEL STATE INFORMATION SYSTEM FOR THE
SAFE DRINKING WATER PROGRAM

VOLUME I: SUBSYSTEM DESCRIPTION
DEFINITION OF SYSTEM REQUIREMENTS

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MODEL STATE INFORMATION SYSTEM

For The

SAFE DRINKING WATER PROGRAM

VOLUME I: SUBSYSTEM DESCRIPTION

DEFINITION OF SYSTEM REQUIREMENTS

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Abstract

The Model State Information System (MSIS) is a computer-based information system which can be utilized by individual States and/or EPA Regions to perform the minimum data management functions mandated by the Safe Drinking Water Act of 1974 (PL 93-523).

Three major documents were produced by American Management Systems, Inc., for EPA outlining the basic concepts of an informational data management system to meet the water quality monitoring and reporting requirements of the Act. These include:

- (Document 1) Feasibility Study for Development and Implementation of a Model State Information System for EPA's Safe Drinking Water Program. June 15, 1976
- (Document 2) Introduction to the Model State Information System (MSIS). June 15, 1976
- (Document 3) Model State Information System for Safe Drinking Water Program. June 15, 1976. 3 volumes

The South Western Ohio Regional Computer Center (SWORCC) has been engaged by EPA to perform the detailed system design, programming, testing, and documentation of the MSIS. The detailed development phase is currently underway, and all work should be completed by early March 1977.

The MSIS consists of eight subsystems: (1) Public Water Supply Inventory; (2) Water Quality Compliance; (3) Regulations; (4) Federal Reporting; (5) Variances and Exemptions; (6) Enforcement Actions; (7) Sanitary Survey; and (8) Operator and Mailing.

The first four subsystems comprise the basic package, which is required if any portion of the MSIS is to be used. States may select the base package and one or more optional sub-systems, depending on their volume of data and individual needs.

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PREFACE

This document presents the definition of the inputs, outputs, files, processing steps, and timing requirements of a Model State Information System (MSIS) to assist states implement the requirements of the Safe Drinking Water Act. This definition, referred to as a "general design" of an information system, was done at a level of detail required for evaluating the technical and administrative feasibility of developing a centralized or decentralized system. In order to implement MSIS, under either option, this general design must be followed by a detailed system design, which defines in detail the various components of the MSIS. The detailed design could lead to changes of a technical nature such as file structures and integration of modules; however, the basic inputs and outputs should not change significantly.

I. SYSTEM OVERVIEW

A. Introduction

This document is part of a feasibility study of the proposed concept for a Model State Information System (MSIS) for the EPA Safe Drinking Water Program. It defines the elements (inputs, outputs, files, and processes) of the proposed MSIS at the level of detail required to prepare reasonable estimates of resource requirements and costs of development and operation of the MSIS, either as a stand-alone system to be run on each state's facility, or as a centralized system to be run at EPA, using STORET. It also serves as a basis for the detailed design of the MSIS.

Section II of a previous report, Program Evaluation Requirements, Concepts, and Plans for the EPA Safe Drinking Water Program (prepared for the Office of Water Supply at EPA by American Management Systems, Inc. under Contract No. 68-01-1939), presents the system concept of the MSIS. As described in that report, the purpose of the MSIS is to provide the states with the capability to perform the minimum set of basic data management functions required to operate a satisfactory enforcement program. The following ten subsystems (or functions) were identified as constituting a minimally acceptable data management system.

- Public Water System (PWS) Inventory Subsystem*
- Water Quality Compliance Subsystem*
- Variances and Exemptions Subsystem
- Laboratories Inventory Subsystem
- Enforcement Actions Subsystem
- Sanitary Surveys Subsystem
- Mailing Subsystem
- Regulations Updating Subsystem*
- Federal Reporting Subsystem*
- Management Reporting Subsystem

Not all of these functions need be automated. The four that are marked with an asterisk must be automated if any of them are to be; the others may or may not be automated, depending on the size, volume of data, and preferences of the individual state. In addition, three changes were made to the initial list of subsystems. One is the elimination of a separate Management Reporting Subsystem since the variety of report formats that will be available for use by each of the other subsystems fulfills management reporting requirements. A second change is the elimination of the Laboratories Inventory Subsystem as an automated feature of the MSIS because the small number of laboratories which will be certified for analysis of drinking water does not justify the development of an automated system. The final change is the expansion of the Mailing Subsystem to include the maintenance of data on certified operators; this subsystem is now called the Operator and Mailing Subsystem.

The identification and definition of the MSIS inputs and outputs presented in the following sections of this paper are independent of the hardware/software combination that will be used to implement the MSIS; that is, individual state facilities or the EPA central facility. However, the definition of files, programs, and processing is dependent in some ways on where the MSIS is implemented. The definition of technical requirements presented here is for a system that each state can implement on its own computer. It can be adapted to be implemented on the EPA computer, using STORET, by combining some functions, replacing some of them with STORET, and adding MSIS-STORET interfaces.

It must be noted that, in general, computer files and reports are not considered as "legally admissible evidence" and therefore MSIS files and reports do not replace the need to keep the original documents.

B. General System Approach

Under the new National Interim Primary Drinking Water Regulations, the states can reasonably be expected to be responsible for performing a minimum set of functions. The definition of the MSIS presented here will give the states the capability to fulfill their responsibilities with some degree of variability. The system is not designed to satisfy all possible desires of all states, but it does provide a certain amount of flexibility in adapting the MSIS functions to individual states. The principal areas in which each state will have the ability to modify the system without changing the computer programs are:

- The selection of what portions of a file will be used in creating the MSIS reports. Our system definition contains a flexible report selection language, enabling states to define the data to be contained in reports; however, report formats are predefined and cannot be changed. (See Section II.C).*
- The definition of what makes up the drinking water regulations. As long as the structure of the regulations remains unchanged, states may modify or add to the regulations table. For example, more chemicals can be analyzed, the state may define sampling requirements that are more stringent than the standard ones, the state may require a different MCL, etc.

It must be emphasized, however, that any change in the structure of a file or in editing requirements will require program changes.

Since the available computer hardware and software will differ among states, the MSIS is designed to be implemented using a standard programming language and primarily using sequential files that can be stored either on magnetic tape or disk.

States also differ in the extent to which they already have ADP systems supporting their existing water supply programs. Even those states which already have an automated system for managing drinking water quality data probably lack some of the functions planned for the MSIS. These states

will want only portions of the MSIS. Therefore, the concept of a modular system has been carried over from the initial system concept, providing states with a choice regarding which subsystems of the MSIS they wish to implement. At the same time, care has been taken to use the same technical approach to file creation and maintenance for all subsystems. Error handling and update reporting has been standardized throughout the MSIS to facilitate the use of the same programming techniques in implementing the data entry and update modules for each subsystem. This approach should lead to efficient implementation, and, at the same time, will contribute to more efficient operations after the MSIS has been installed in a particular state.

C. File Maintenance Approach

The initial creation of a record on most of the MSIS files is accomplished by the ADD transaction, which contains only the record identification. This transaction will cause a record to be created on the appropriate file, containing no data except record-ID. The addition of all subsequent data referring to that particular record-ID is accomplished by means of UPDATE transactions. This feature allows the user to identify the necessary record-IDs he may need on a particular file without having to know any specific information about them.

The data on an MSIS UPDATE transaction will be edited and applied to the MSIS files on a field by field basis. Any erroneous transaction fields will not cause the entire transaction to be rejected; rather, valid fields will be applied against the MSIS file. In this way, a few bad transaction fields will not prevent the majority of the data elements of a record on a file from being updated in as timely a manner as possible. Also, error correction procedures will be simplified, in that only the erroneous fields of a given transaction need be re-entered on the transaction for re-submission to update processing.

Since most UPDATE transactions for the MSIS refer to several data elements, the following approach has been decided upon:

- On any given transaction, if the field corresponding to a data element is blank, the data element on the file is not modified.
- If the transaction field contains a predefined special character (such as '@') in its rightmost position, the value of the data element on the file will be re-initialized.
- Any other value in the field will be used to replace the current value of the data element in the file, provided that the transaction value is valid.

Section II of this document describes the MSIS files and the functions common to all subsystems of the MSIS. Sections III through XI describe the preliminary definition of the eight subsystems making up the MSIS. Three appendices provide a summary of major changes, discussion of violation identification, and a suggestion for providing the states with initial PWS Inventory File. Preliminary layouts of input forms, file formats, and report formats are contained in a separate volume (Volume II) in order to facilitate reviewing them concurrently with the description of the corresponding subsystem. Volume III contains preliminary descriptions of each data element that has been identified as necessary for the MSIS. Please refer to this Data Element Dictionary whenever the purpose and usage of a data element are not clear.

II. FILES AND COMMON FUNCTIONS

A. Files and Tables

The MSIS maintains eight permanent files and four major tables. These files and tables are reviewed in the following paragraphs. Record layouts are exhibited in Section II of Volume II. Individual data elements are described by the Data Element Dictionary (Volume III).

1. The Public Water Systems Inventory File (PWSIF)

The PWSIF is the central file of the MSIS. It contains a record of each PWS in the state. The file is sequentially organized with variable length records. Record layout is shown in Exhibit II.2.

Data elements to be maintained for a PWS include those required for the EPA's national PWS inventory file, plus additional data elements needed for MSIS operation, such as state discretionary data. A large area in each record is reserved for state usage. The PWSIF is maintained by the PWS inventory subsystem.

2. The Public Water System Inventory Table (PWS Table)

Most of the Water Quality Compliance Subsystem reporting modules need an access to data elements from the PWSIF. Because these reports are not listed by PWS-ID, retrieving the required data elements directly from the PWSIF will necessitate additional sorting and reading of the file. To eliminate this problem, a PWS table is used. The table contains the data elements that are required for most reports, and it is organized as a direct-access file. Exhibit II.17 contains the layout of a table entry. The PWS Table is recreated automatically by the PWS Inventory Subsystem each time the PWSIF is updated.

3. The Samples and Analysis File (SAF)

The SAF is the principal file to be maintained by the Water Quality Compliance Subsystem (WAQC). There are two versions of the SAF.

a. The Periodic Samples File

This file contains a record for each sample transaction entered to the WAQC Subsystem. The records are in the exact format of the transactions. Periodically, data will be summarized and posted to the permanent SAF.

b. The SAF

The SAF contains a record for each sample that was analyzed for chemical or radioactive contaminants, and a summary record of samples made for turbidity and bacteriological analysis. Each time records are copied to the SAF or a summary record is posted to the SAF, the record that was copied or summarized is deleted from the Periodic Sample File.

The SAF is organized as a sequential file with variable length records. Exhibits II.7, II.8, and II.9 contains layouts of the various SAF records.

4. The Variance and Exemptions File (VEF)

The VEF contains a record for every variance or exemption granted by the state to a PWS. A V & E record is added to the VEF only if EPA had not objected to. Data elements contained in each record enables the state to monitor V & E compliance schedules as well as maintain data for the annual reporting to EPA.

5. The Laboratory Table

The Laboratory Table is used as a verification aid for data entry of water samples. The table is created and maintained manually, and is organized as a direct access file. Each entry (record) contains the laboratory identification, contaminant-groups the laboratory is authorized to analyze, and analysis methods used. Exhibit II.12 is the layout for the Laboratory Table records.

6. The Enforcement Actions File (EAF)

The EAF contains a record of every enforcement action monitored by the state that deals with enforcement of the drinking water regulations. The EAF is maintained by the Enforcement Actions Subsystem and it is sequentially organized with variable length records. See record layout in Exhibit II.13.

7. The Operator and Mailing File

The Operator and Mailing File is used to maintain addresses for the purpose of monitoring the qualifications of certified operators and for printing mailing labels. It contains records of certified operators as well as other addresses. The file is sequentially organized with variable length records. See layout in Exhibit II.14.

8. The Regulations Table

The Regulations Table is a file containing the federal and state drinking water regulations. The file is sequentially organized with variable length records. Modules that use it read the file in its entirety and create an internal table. Record layouts are shown in Exhibits II.3 to II.6. The Regulations Table is maintained by the Regulation Subsystem. Note that each time the table is created, all data elements must be visually verified.

9. The Violation File

The Violation File contains a record of each violation of the drinking water regulations. Violations of contaminant level and violations of sampling frequency requirements are posted automatically to the file. Other violations must be entered manually. The file is sequentially organized with fixed length records. It is maintained by the Water Quality Compliance Subsystem. The record layout is shown in Exhibit II.10.

10. The Deviations File

The Deviations File contains a record of each violation, variance, and exemption that is maintained on MSIS files. The file is created by the Federal Reporting Subsystem, and is used to report to EPA on violations, variances, and exemptions. Records are posted automatically to the Deviations File from the VEF and the Violations File. The file is sequentially organized with fixed length records. See record format in Exhibit II.15.

11. The Analysis Methods Table

This table contains an entry for every analysis method used for analyzing drinking water samples. It is used as a verification and reporting aid and is manually maintained. The table is organized as a direct access file. See record layout in Exhibit II.16 and the code table in Exhibit IV.2.

12. MSIS History File

This file contains a record for every change made to any of MSIS permanent files including a deletion of a record. In this way it is possible to reconstruct the history of a record and provide an audit trail. Since more data is required for keeping track of a PWS record than other records there are two versions of the MSIS History file one for PWSIF history and the second for other files.

B. Common Functions

All inputs to the MSIS are in the 80-column punched card format. Each subsystem which maintains a central file will have its own transaction layouts and editing and updating algorithms. However, the processing and reporting of erroneous transactions and the maintenance procedures for the MSIS History File are the same for all subsystems. The following paragraphs of this section describe these common functions. During the detailed design to phase, more common functions may be identified, much as maintaining tables. Such additional common functions will be also handled by commonly used modules

1. Standard Error Handling - Module MSIS010

a. Function

To prepare report MSIS010R - Data Entry Error Report for Subsystem, and create an optional errors file. See flowchart in Figure II.1.

b. Inputs

1. Transactions in error file. To each transaction (80-characters) are suffixed the data element code (3-characters) and the error code (3-Characters).

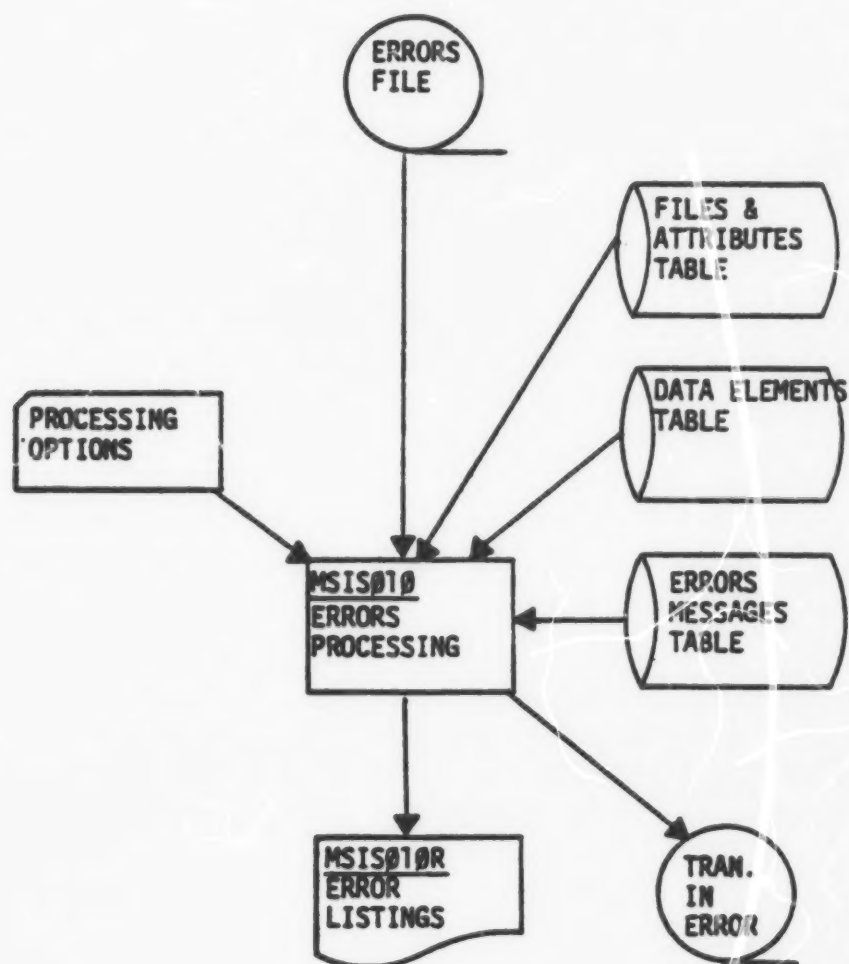
2. Error Messages Table. This table is standard for all files. It is sorted by a three-digit error code, and contains a 20-character description of the error.

Example: 120 non numeric
135 not valid

3. Data Elements Table. There will be a Data Elements Table for each file (or subsystem). Each entry in the table consists of:

- 3-digit data element code;
- 2-digit starting position (column);
- 2-digit ending position (column); and
- 15-characters containing the data element name.

FIGURE II.1
ERROR HANDLING



4. File Attributes Table. This table will contain an entry for each file in the MSIS. Identification will be according to the file short name, such as PWSIF, EAF, etc. In each entry, the following data is provided:

- Headline (75 characters)
- Data Elements Table Identification
- Start and end positions of the transactions key (2-characters)
- For every data element that may be used in sorting the errors:
 - MNEMONIC
 - Start and end positions (2 + 2 characters)
 - Indicator for page skipping on change of value of data element when used in a sort-key.

5. Processing Options. Processing options will be communicated to the module by input records (presumably a punched card) in the structure:

- 5 characters file name;
- 1 character to indicate if an output error file is to be created;
- 1 character if it is desired to erase from the list the output error file fields which are not in error;
- 1 character to indicate if transactions in error that were automatically generated by another subsystem are to be ignored;
- Up to 4 data element names (8-characters each) to be used as sort parameters, in the order of sort.

c. Outputs

1. Report MSIS010R - Data Entry Error Report For Subsystem. See layout in Exhibit III.1.
2. An optional Errors File containing 80 column records in the image of the original transactions.

d. Process

1. Processing options are read and verified.
2. The Errors File is sorted at the user's option. Possible options are:
 - by source document number and state;
 - by PWS-ID (state ID number);
 - any of the above, but within district.
3. After the sort, the error records will be printed in an errors report. If transaction contains more than one error, the transaction itself will be printed only once for all errors. Optionally, only fields that contain an error are printed, in addition to the transaction keys; this eliminates re-entering valid fields. The error message will contain the field name, column positions and error message (See Exhibit III.1). The error message will be in a table and retrieved by the field code and the error code. At the top and bottom of the page, a string of 80 columns will be printed to provide positioning information for the people correcting the errors and for keypunch.
4. When the sort made is according to district, a new page will be started when the district is changed.
5. An optional Transaction in Error File will be created, containing one record per transaction in error. This file can be used to punch cards or to correct the errors using a text editor.

2. MSIS History File Maintenance - Module MSIS020

a. Function

The Update Module maintains the MSIS History File for all files except the PWSIF and prints the Update Report (MSIS020R) either for a single update run or the entire updating history of a file. See flowchart in Figure II.2.

A record of the PWS History File contains more data than the records on the common MSIS history file and, as a result, the update report for the PWS contains additional data fields. For these two reasons, the maintenance of the PWS History File is handled by a separate module with similar functions to Module MSIS020 (See Section III).

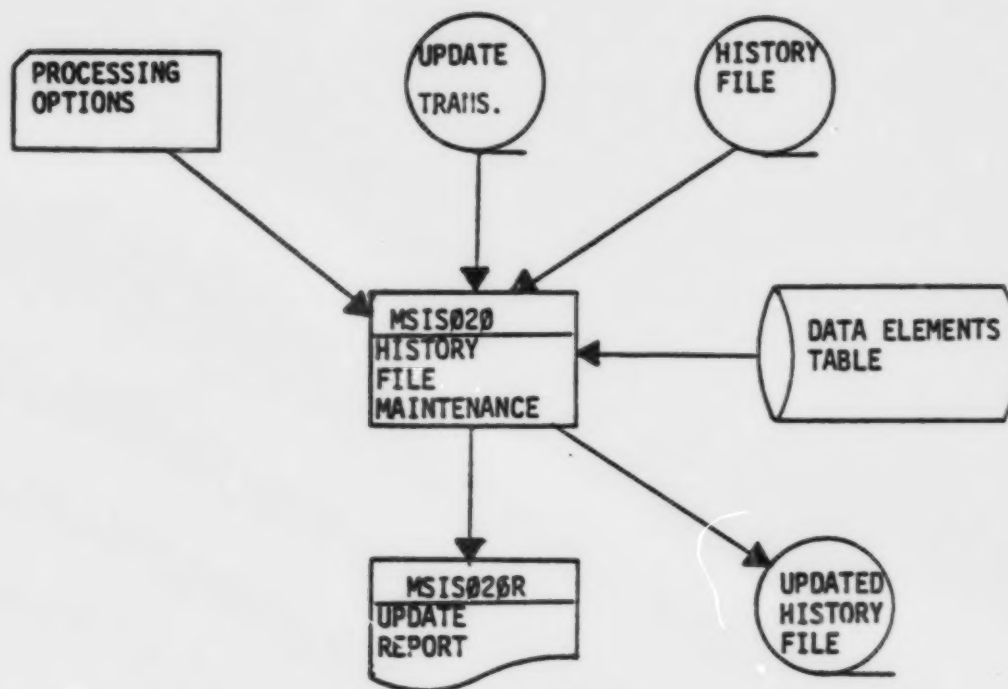
b. Inputs

- Update records from all subsystems except the PWSI subsystem
- Processing options. The options are to print the update report from the update transactions or to print the entire history of the file from the MSIS History File. The option must be specified for every MSIS file.
- MSIS History File, which is the accumulation of the results of all update transactions, sorted by file-ID, record-ID, update date, and data element code.
- Data Element Table.

c. Outputs

- An updated version of the MSIS History File;
- Report MSIS020R - Update Report for File (Exhibit III.2).

FIGURE II.2
HISTORY FILE MAINTENANCE



d. Process

- The processing options are read and verified.
- Update records are sorted by file-ID, record-ID, update-date, and data element code.
- Update records are merged with the MSIS History File to create the updated version.
- The option for the current MSIS file is examined:
 - if a current report was requested - only the new update records are listed;
 - if an entire history report was requested - all the records from the MSIS History File are listed.
- Whenever a report is started for a new MSIS file, the printing skips to top of next page and the page counter is reset to one.

C. A Simplified Query Language

The people responsible for enforcing the drinking water regulations must have some vehicle to select and examine records from files according to ad hoc requirements. A simplified query language as described below, provides such a tool.

A data element table is created containing the description, i.e. name, type, position, length etc., of data elements in all files to which the selection option applies, i.e. all major system files.

Since the structure of this table can be standardized for all files, a single consolidated selection module can handle the selection function most effectively for all files. Operationally, a subsystem module reads selection criteria input, and if it determines that this request can be legitimately processed by that module it transfers control to the common selection module which edits individual data names, sets up the selection table and executes the selection logic. The submission report requests and the names in which they are processed by the system are described below.

In order to scan a file and select records for retrieval, a query must begin with a card which contains the name of the requested report and sort parameters. Following the leading card are selection criteria using unnested 'OR' and 'AND' operators in the following format:

<u>COL.</u>	<u>PARAMETER</u>
1-3	Operator: AND, OR (OR is the default)
5-14	Field name, e.g. REGION, POPSIZE, PWSTYPE
15-16	Relation: LT (Less Than) EQ (Equal) GT (Greater Than) NL (Not Less Than) NG (Not Greater Than) NX (Not exists (empty) on file)
20-50	Value for selection.

For example, if one wanted a report containing all public water system records on the PWSIF which are in District 11 and either have PWS TYPE = 2 or serve a population of less than 4,000 people, or are surface sources, the following selection language might be used:

```
AND DISTRICT EQ 11
OR PWSTYPE EQ 2
OR POPSIZE LT 4000
OR SOURCE EQ SUR
```

This report request is validated by the PWS Inventory subsystem which then calls in the common selection routine. The latter routine edits each data element in the request against the corresponding table values; sort parameters are edited in a similar manner and verified to ensure that the combined length of all sort parameters (Sort Key) does not exceed the maximum length allowed. This common selection module then rearranges the selection data so that 'AND' cards follow 'OR' cards to facilitate the selection logic which, in the above example, would be applied to each PWS inventory record:

- PWS type = '2'?
- if yes, continue at first 'AND' card
- if no, continue at next 'OR' card
- Population Size < 4000?
- if yes, continue at first 'AND' card
- if no, continue at next 'OR' card
- Source = 'SUR'?
- if yes, continue at next 'AND' card
- if no, there are no more 'OR' cards, and this record did not meet any 'OR' selections and therefore is not selected.

- District = '11'?

-- if yes, continue at next 'AND'. Because there is not an additional 'AND', the record met selection criteria and is selected.

-- if no, the record failed a 'MUST' selection criteria, and is not selected.

If the individual record is selected, it is passed to the respective subsystem for further processing, i.e. writing to intermediate report files and report generation. It is important to note that the internal operation of the selection module and the passing of control between the subsystem module and the selection module are functions totally transparent to the user since the interface is built into the system; details regarding the manner and type of interface should be fully defined during detailed system design.

III. PUBLIC WATER SYSTEM INVENTORY SUBSYSTEM

A. Overview and Purpose

The Public Water System Inventory Subsystem is at the heart of the Model State Information System. This subsystem maintains descriptive data about public water systems on a PWS Inventory File (PWSIF) which is also used by other subsystems. The principal function of the PWS Inventory Subsystem is to create and maintain this file and to display its contents upon request.

Inputs to the subsystem consist of source documents that are transcribed on special input forms and then keypunched. The regular process is to read the input transactions and edit and verify all verifiable data. Transactions without errors are used to update the PWSIF file, and those in error appear on an error list produced to facilitate correction of errors. Periodically and upon request, the PWSIF can be used to list an inventory of public water systems and other information for use by state officials.

The updated inventory file is used in the following subsystems of which it is an essential part:

- Water Quality Compliance Subsystem;
- Federal Reporting Subsystem; and
- Sanitary Survey Subsystem.

In addition, some basic descriptive data is maintained in an on-line PWS Table that is used as a verification aid by all the other subsystems.

Figure III.1 shows the general flowchart of the PWS Inventory Subsystem. In this overall design, each of the seven major components of the PWS Inventory subsystem are presented as separate modules and the inputs, outputs and general processing logic of each is described in this section:

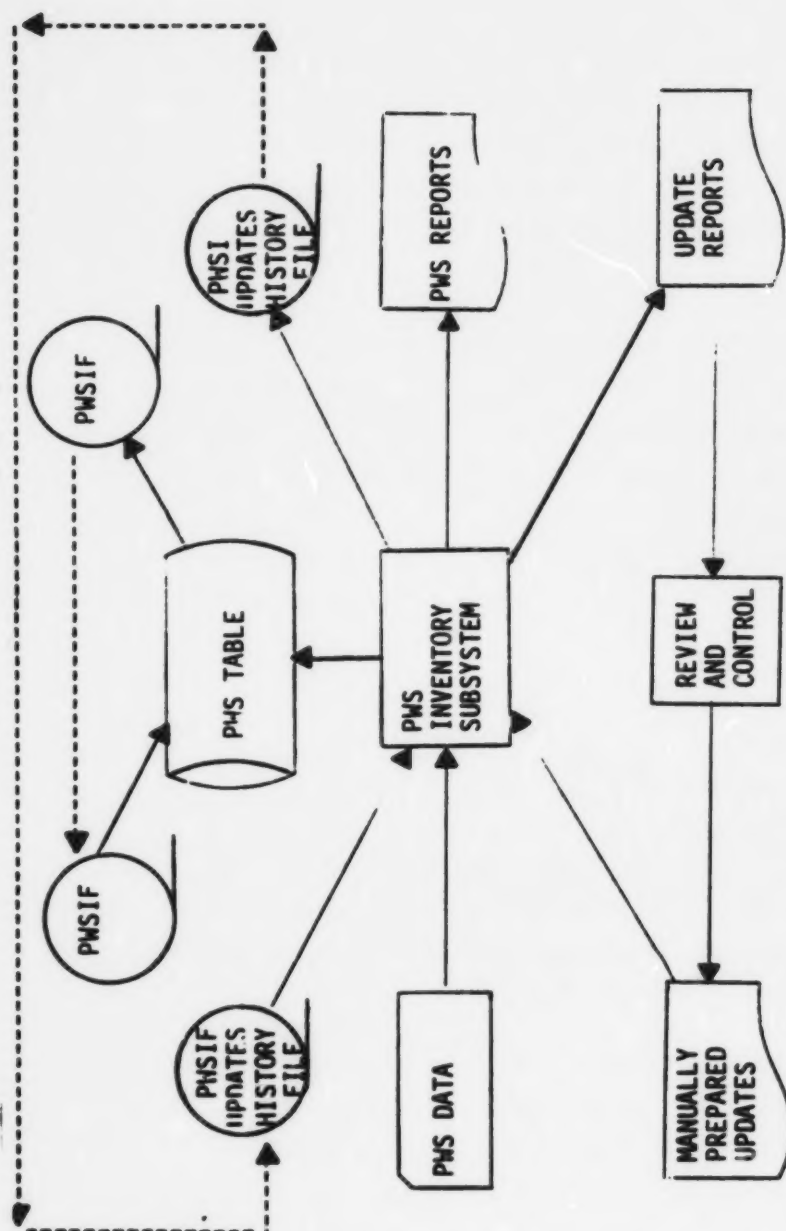


FIGURE III.1
THE PWS INVENTORY SUBSYSTEM

- data entry and updating (PWSI010),
- selection for reporting (PWSI020),
- condensed listing (PWSI030),
- production data listing (PWSI040),
- state discretionary data listing (PWSI050),
- comprehensive listing (PWSI060), and
- history file maintenance and reporting (PWSI070)

This does not mean, however, that there should be seven separate programs for this subsystem. A key detailed design task will be to translate this function oriented design into a set of discrete computer programs that are easy to operate and understand. For example one option may be to incorporate the several listing modules into one program so that the selection and listing functions are performed in a single operation.

The main features of the PWS Inventory System are:

- Inputs do not depend on automation of other subsystems;
- Sequential files;
- Variable length record for each PWS;
- Flexible reporting modules that allow the user to specify selection criteria and sort sequence, but within predetermined print formats;
- Off-line and batch processing;
- Suitable for annual reporting to EPA for the maintenance of the National PWS Inventory;
- Program modules that contain exit points for additional code developed by state personnel for their specific needs.

The benefits from the subsystem are:

- Provides a uniform method for managing data necessary for reporting to EPA;
- Provides a basis for enforcing the State and Federal Drinking Water Regulations by providing the basic descriptive data required for compliance monitoring and reporting;
- After the initial creation of the PWSIF File, the regular operation would be simple and inexpensive while providing information and reports that would be cumbersome to produce manually.

B. Input Transactions

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The inputs to the PWS Inventory Subsystem emanate from:

- EPA National PWS Inventory File (an initial conversion process);
- Sanitary surveys;
- Permits for new PWSs; and
- Updates received from PWS operators.

Except for data from the EPA National PWS Inventory File, all inputs must be transcribed on a single input form that may be used for all these transactions (See Exhibit III.6).

The Input transactions are based on the 80 column card image. Each transaction is identified by the following fields:

- PWS-ID (7 positions)
- Card and transaction code ('00' to '99')
- Input form number and date or, if transaction was generated by another subsystem, the identification of the program that prepared it (5 to 6 positions).

The transaction key requires 20 positions, and the remaining 60 positions are available for data elements.

Instead of the usual "Add, Change, Delete" format used in other subsystems, there will be only one "Add" transaction - transaction type '00'. This transaction will create a new PWS record with no data except the PWS-ID. All other transactions are "Change" transactions. No deletions of PWS record will be allowed by the system; rather, transaction type '99' will be used to deactivate a PWS record. Inactive records may be transferred to a history file after being in inactive status for more than two years.

Exhibit III.6 contains the format for PWS status and entry. This form serves two purposes:

- As an input form for the creation of a new PWS record; and
- As a turnaround document on which a PWS status is printed and which can be used to make changes and corrections to the record.

The "Change" transactions are as follows (See Exhibit III.6 and the Data Element Dictionary for full details):

1. Transaction '01' - used to change the value of PWS-Name and the first address line of the mailing address.
2. Transaction '02' - used to change the values of the second address line, the state and zip code of the mailing address, and the telephone number.
3. Transaction '03' - used to change the values of the two address lines of the plant location.
4. Transaction '04' - used to change state and zip code of the plant location, and the city and county served by the PWS (service area location). In addition, this transaction is used to change the Indian Reservation Code and Service Area Characteristics.
5. Transaction '05' - used to change the value of:
 - Activity code;
 - Reason for deactivation;
 - Deactivation date;
 - Compliance cycle;
 - Owner type;
 - Regulations code;
 - PWS type;
 - Interstate carrier code;
 - Region;
 - District;
 - Consecutive system flag;
 - PWS-ID of the supplier of water (seller);
 - Water type of the seller;
 - Date PWS began operations;
 - Manual file reference; and
 - Bacteriological and turbidity reporting requirements flags.

6. Transaction '06' - used to change the value of:

- Size of population served;
- Number of services;
- Number of meters;
- Number of consecutive PWSs;
- Operation report flag; and
- Date of last operation report.
- Average air temperature

7. Transaction '07' - used to change the value of:

- Production capacity (average capacity);
- Emergency power capacity;
- Distribution Storage, gravity flow; and
- Maximum daily production.
- Design capacity
- Date of last sanitary survey

8. Transaction '08' - used to change the value of:

- On-site laboratory control flags;
- Laboratory identification number and captive laboratory flag for laboratory used for bacteriological, organic, inorganic, radiological and physical analysis.

9. Transaction '09' - used to change the value of data elements that modify the federal regulations concerning bacteriological monitoring that can be changed at a state's discretion:

- Flag indicating monthly monitoring instead of quarterly monitoring;
- Number of samples per quarter for small non-community PWS;
- Season starting date (month and day) for a non-community PWS;
- Season ending date (month and day);
- Alternate monitoring frequency, in days; and
- Percent of samples that can be replaced by chlorine residual sampling.

10. Transaction '10' - used to change the value of the alternative MCL for turbidity, at the state's discretion.

11. Transaction '11' - used to change the values of data elements that modify the federal regulations concerning organic and inorganic chemicals and radioactive monitoring that can be changed at a state's discretion.
 - Month and day of the start and the end of the monitoring season for organic chemicals;
 - Organic chemicals monitoring waiver flag;
 - Nitrate monitoring frequency; and
 - A flag indicating that the PWS must be monitored for radioactive contaminants.

12. Transaction '12' - used to enter, change, or erase follow-up monitoring of chemical contaminants after the MCL is exceeded and public notification given. For each chemical (up to 2), the Contaminant-ID and monitoring frequency (days) are specified. This transaction is also used to enter, change, or erase variance or exemptions when applied to MCL. For each applicable V&E (up to 2), the Contaminant-ID and the modified MCL are specified.

13. Transaction '13' - used to enter, change, or erase data elements relating to each source of water. A source is referred to by its sequential number within the PWS record (up to 15 sources). Data elements kept for each source are:
 - Source name;
 - Source type;
 - Number of wells;
 - Availability Code;
 - River Basin number;
 - Latitude;
 - Longitude; and
 - Treatments used (up to 13 different treatments).

14. Transaction '19' - used to request a comprehensive listing of PWS records. The transaction contains only the PWS-ID and the transaction code.

1. Function

This module accepts input transactions into the PWSI subsystem, edits them and uses valid transactions to update the PWSIF. Incomplete records are isolated for reporting purposes. It also creates the PWS Table that is referenced during report generation. This module will be run as often as necessary according to a schedule adopted by each state to keep the PWSIF up-to-date. During the first months of implementation, an update run may be necessary every day or every other day, but, thereafter, a weekly or bi-weekly run should suffice.

Figure III.2 shows the flowchart of this process.

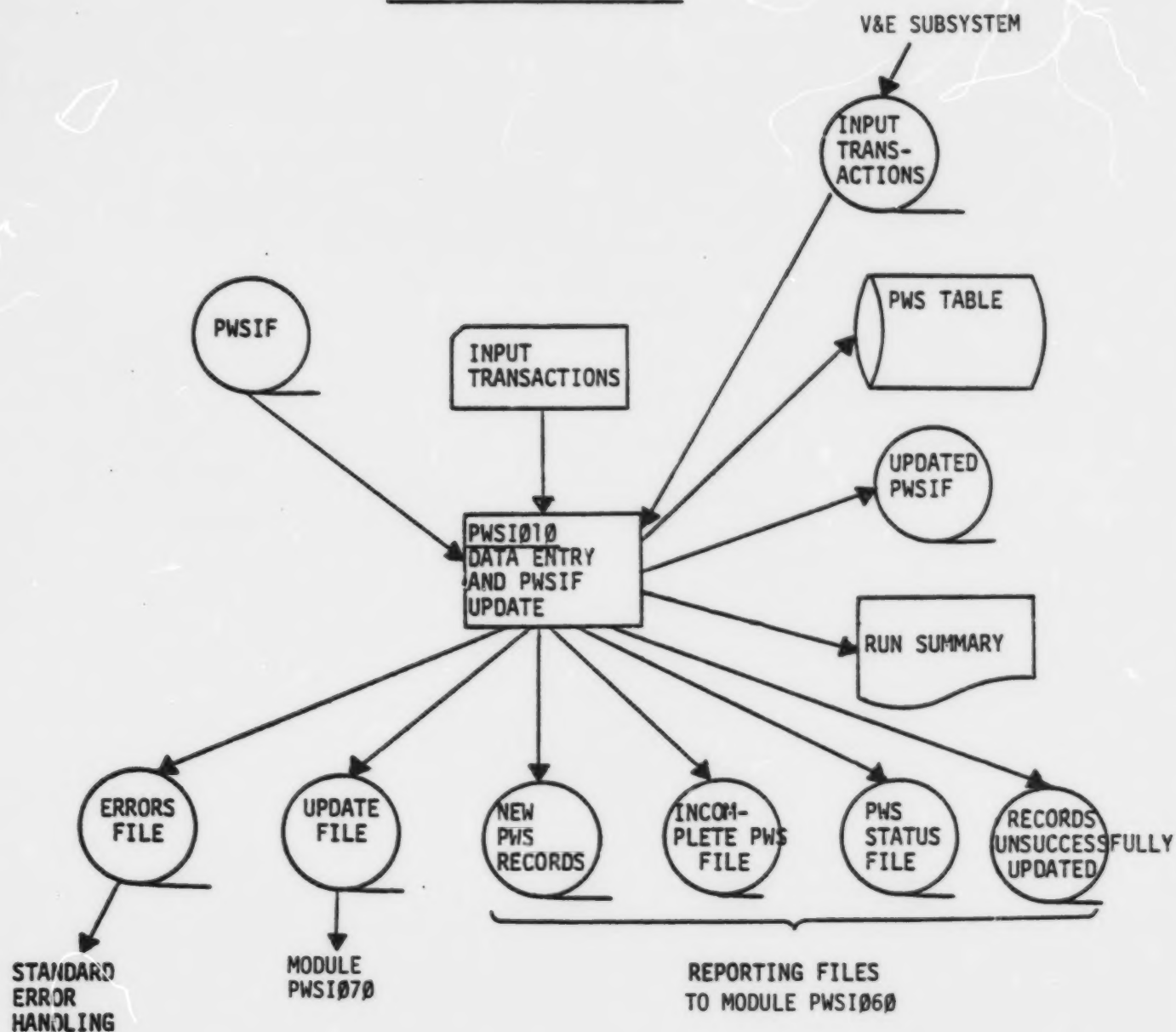
2. Inputs

- Transactions from the V&E subsystem;
- Transactions keypunched from input documents; and
- The PWSIF.

3. Outputs

- An updated version of the PWSIF.
- The PWS Table (contains descriptive data about each PWS to be used for reporting purposes).
- Errors file, to be processed by the MSIS standard errors handling procedure (Module MSIS010).
- Update results file to be processed by the PWS History File Maintenance (Module PWSI070).
- Four intermediate files containing PWS records selected for comprehensive listing (Module PWSI030). The four files contain:
 - New PWS records;
 - Incomplete PWS records;
 - PWS records with an update transaction in error; and
 - PWS requested for status listing.
- Run summary report (to be designed during the detail design phase) containing information such as:
 - Number of PWS records on the PWSIF;
 - Number of PWS records added this run;
 - Number of PWS records deactivated this run.

FIGURE III.2
DATA ENTRY AND UPDATING



4. Process

This section outlines the overall processing logic of this module; development of specific edits logic, acceptable values for each data element, etc., will be one of the detail design tasks in the next phase. In general terms, the several processing steps in this Data Entry and Update Module are:

- Transactions are sorted by PWS-ID and transaction code.
- Each transaction is read and all verifiable data elements are edited. If the transaction contains an invalid data element, it is written on the errors file.
- Valid transactions are matched against a corresponding PWS record from the old PWS Inventory File.
- If there is a corresponding PWS record:
 - and if transaction code is '00' (add a PWS record) this is an error;
 - for all other transactions, edit individual data elements, flag those in error and update those that are valid.
- If there is no corresponding PWS record:
 - and if transaction code is '00', create an empty record for the new PWS-ID.
 - if transaction code is other than '00', reject it because it refers to a non-existing PWS-ID and is therefore in error.
- If a transaction is in error, an error record will be created containing the data element code, error code, and the source transaction. This record will be then written on the Error File.
- The update process consists of replacing the value of a data element with a validated new value. The transaction identification (code, PWS-ID, form identification), PWS name, the old and new values of the data element, and the date of last update comprise an update result record which is written to the Update Results File, and the PWS History File.

- After a PWS record is updated, the current date is entered into the Date of Last Update field.
- If an error was detected during updating of a PWS record, the record is written to the appropriate intermediate file.
- Each PWS record, whether it is updated in the current cycle or not, will be checked to make sure that all required data elements exist. If this is not so, the PWS record is written on the incomplete PWS File (See 5. Required Data Elements).
- All PWS records are written on the updated version of the PWSIF after their processing is finished.
- If the special transaction requesting PWS status exists for a particular PWS, its record is written to the PWS Status File.
- Summary statistics are cumulated during the processing and listed at the termination of the run.

5. Required Data Elements

A PWS record has the capacity to contain more than a hundred different data elements; realistically, however, it would probably not be feasible to obtain all these data at implementation. Moreover, only a few key data elements are required to perform the monitoring function. The following is a list of required data elements for each PWS record. If one or more of these data elements is missing, the record will be written on the intermediate file of Incomplete PWS Records to be listed later on the PWS Status and Entry Form (Exhibit III.6):

- PWS Name
- PWS mailing address: the two address lines, state and zip code
- PWS Type (community or non-community)
- Size of the population served (for community PWS only)
- At least one water source which must contain source type (to identify surface water)
- If the PWS record is flagged as a consecutive PWS, then instead of the water source information, the Seller-ID and Seller-Water type must be present.

All the other data are considered, at this phase, to be optional. It is recommended that each state will evaluate this list at implementation time in order to consider including more data elements in it.

1. Function

The primary function of this module is to scan the PWSIF and select records for reporting. Output files for every report can be selected by one run, using the query language explained in Section II.C. The selection and reporting of required PWS is done on request; however, individual states may wish to establish schedules and run the module periodically, and any special report requests could be included in such a scheduled run.

A flowchart of the selection and reporting process is presented in Figure III.3; the inputs, outputs, and processing logic of the module are described below.

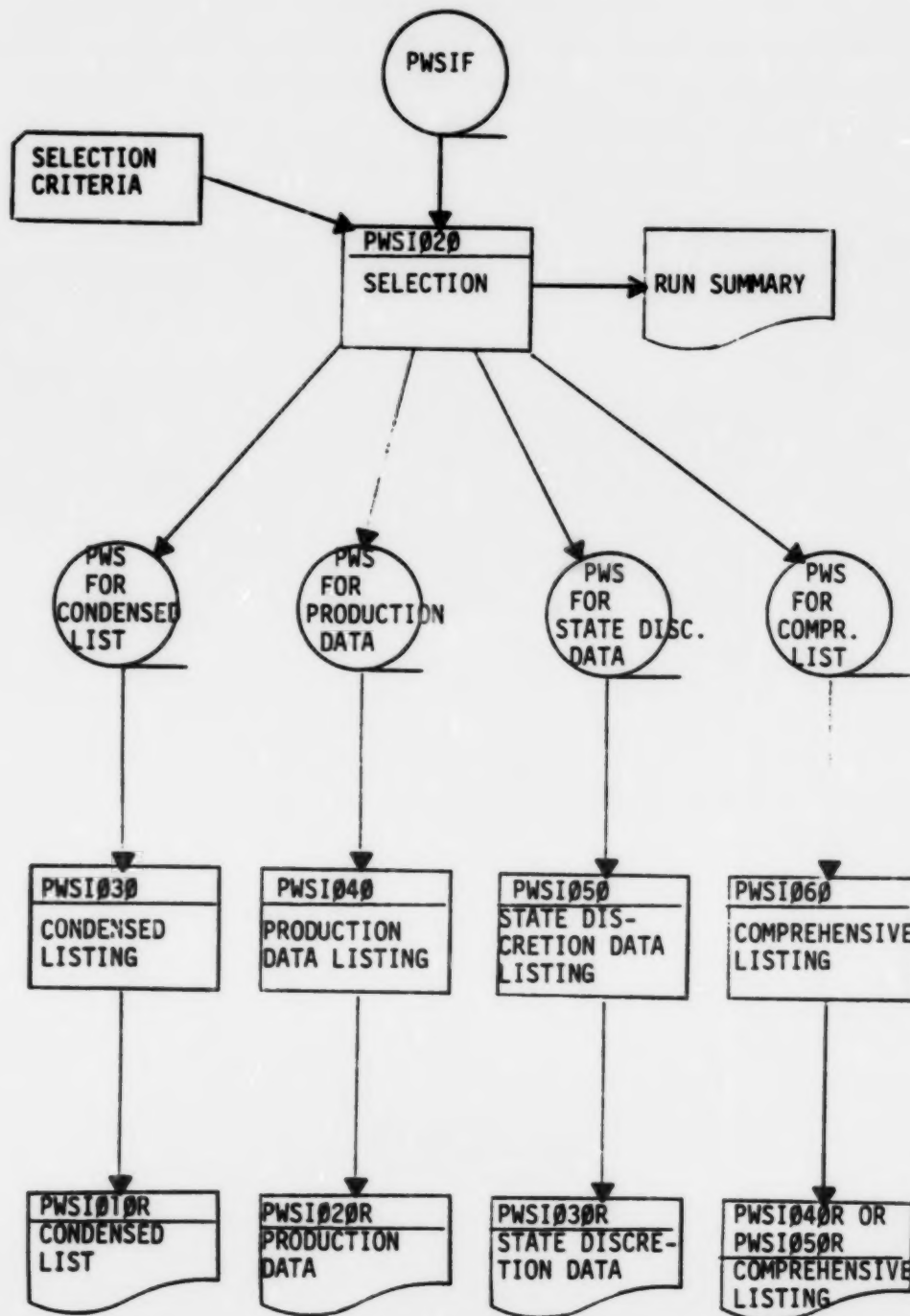
2. Inputs

- Selection Criteria for each report on a header card containing report name and requested sort parameters, followed by the set of query language statements.
- The PWSIF.

3. Outputs

- For each of the four reports described below, an intermediate file containing records which include all data elements needed to generate that report. The first record on each file (except the file for comprehensive list) contains the selection criteria used and sort parameters. The four reports are:
 - Condensed List;
 - Production Data;
 - State Discretionary Data; and
 - Comprehensive List.
- Printed summary of the selection criteria and statistics on the number of records selected for each report (the format of this report will be designed during the detail design phase).

FIGURE III.3
PWS SELECTION AND REPORTING



4. Process

- Read and verify the selection criteria;
- Scan every record on the PWSIF;
- If a PWS record fits the selection criteria for any report, it is written to the appropriate file;
- Print run summary at the end of the run.

E. PWS Condensed Listing - Module PWSI030

1. Function

The principal function of this module is to sort an intermediate file prepared by the selection module PWSI020, and list report PWSI010R - PWS Condensed List (See flowchart in Figure III.3). This report is optional and will be produced only upon request.

2. Input

- An intermediate file prepared by module PWSI020, containing records selected for condensed listing, with sort parameters on the first record.

3. Output

- Report PWSI010R - Public Water Systems - Condensed Listing (Exhibit III.3).

4. Processing

- Sort input file according to the sort parameters on the first record.
- Read each record and print the report.

F. PWS Production Data - Module PWSI040

1. Function

The principal function of this module is to sort an intermediate file prepared by the selection module PWSI020, and list report PWSI020R - Production and capacity data (See flowchart in Figure III.3). This is an optional report to be produced only on request.

2. Input

- An intermediate file prepared by module PWSI020, containing records selected for reporting production and capacity data, with the first record containing sort parameters.

3. Output

- Report PWSI020R - Public Water Systems - Production and Capacity Data (Exhibit III.4).

4. Process

- Sort input file according to the specified sort parameters;
- Read each record and print the report;
- If file is sorted by region and district, skip to a new page whenever there is a change in district or region.

6. State Discretionary Data - Module PWSI050

1. Function

The principal function of this module is to sort an intermediate file prepared by the selection module PWSI020, and list report PWSI030R - State Discretionary Data (See flowchart in Figure III.3). This is an optional report and it will be produced only on request. Individual states may, however, establish a schedule for obtaining this report on a periodic basis.

2. Input

- An intermediate file prepared by module PWSI020, containing records selected for listing their State discretionary data, with the first record containing sort parameters.

3. Output

- Report PWSI030R - Public Water Systems - State Discretionary Data (Exhibit III.5).

4. Process

- Sort input file according to the required sort parameters;
- Read each record and print the report.

H. PWS Comprehensive Listing - Module PWSI060

1. Function

The principal function of this module is to accept a PWSIF type file, sort it and produce a PWS comprehensive listing (reports PWSI040R or PWSI050R). (See flowchart in Figure III.4). When individual states develop their processing schedules for the MSIS, this module could be set up to be processed as the logical next step after certain files are created since the output of the comprehensive listing module could trigger further action. The files for which this procedure is recommended are identified in the Inputs section below.

2. Inputs

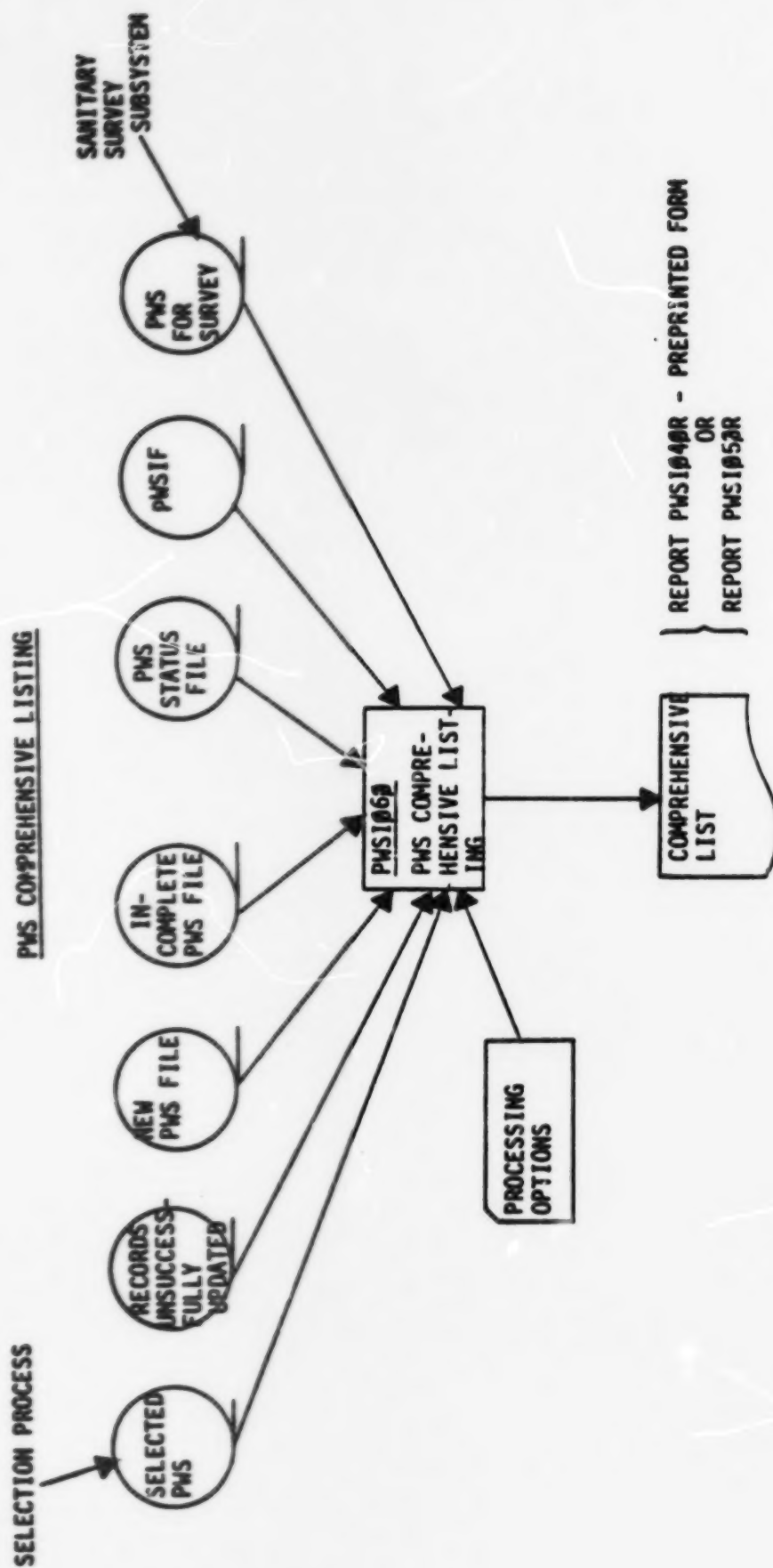
- Processing options, containing the name of input files and the sort parameters required.
- A file with PWS records, in the same format as the PWSIF. This file may be one of the following:
 - An intermediate file containing newly created PWS records (required);
 - An intermediate file containing PWS records which had a related updated transaction in error (required).
 - An intermediate file containing incomplete PWS records (required).
 - An intermediate file containing PWS records for which a status was requested. This file may be generated by the updating module (PWSI010) or by the selection module (PWSI020) (optional in both cases).
 - The PWSIF in its entirety (optional).
 - An intermediate file containing records of PWS that are scheduled for sanitary surveys (optional).

3. Outputs

- PWS comprehensive listing, showing every data element on a PWS record. There are two versions of this list:

FIGURE III.4

PMS COMPREHENSIVE LISTING



- Report PWSI040R - Public Water System Comprehensive Listing (Exhibit III.6), a preprinted form designed to be used as an output report, and input document (i.e., a turnaround document).
- Report PWSI050R - Public Water System Comprehensive Listing (Exhibit III.7) which is designed as an output document only.

4. Process

- Processing options are read and verified.
- Input file is sorted according to the requested sort parameters.
- Every PWS record is read and printed.

I. PWSIF History Maintenance - Module PWSI070

1. Function

This module maintains a PWS History File and prints the PWSIF Update Report (Report PWSI060R) either for a single update run (produced following every update run) or all update transactions processed by the PWS Inventory Subsystem (an optional feature). See flowchart in Figure III.5.

2. Inputs

- Processing options, including:
 - Whether only last update transactions are required or all updates recorded on the history file are to be printed.
 - Sort parameters.
 - An intermediate update file, prepared by module PWSI010, which contains a record for each update action. Data elements in the record are: PWS-ID, PWS name, region, district, source document reference, data element code, old and new values.
- The Data Elements Table for the PWSIF.
- The PWS History File, consisting of all update result records since system implementation.

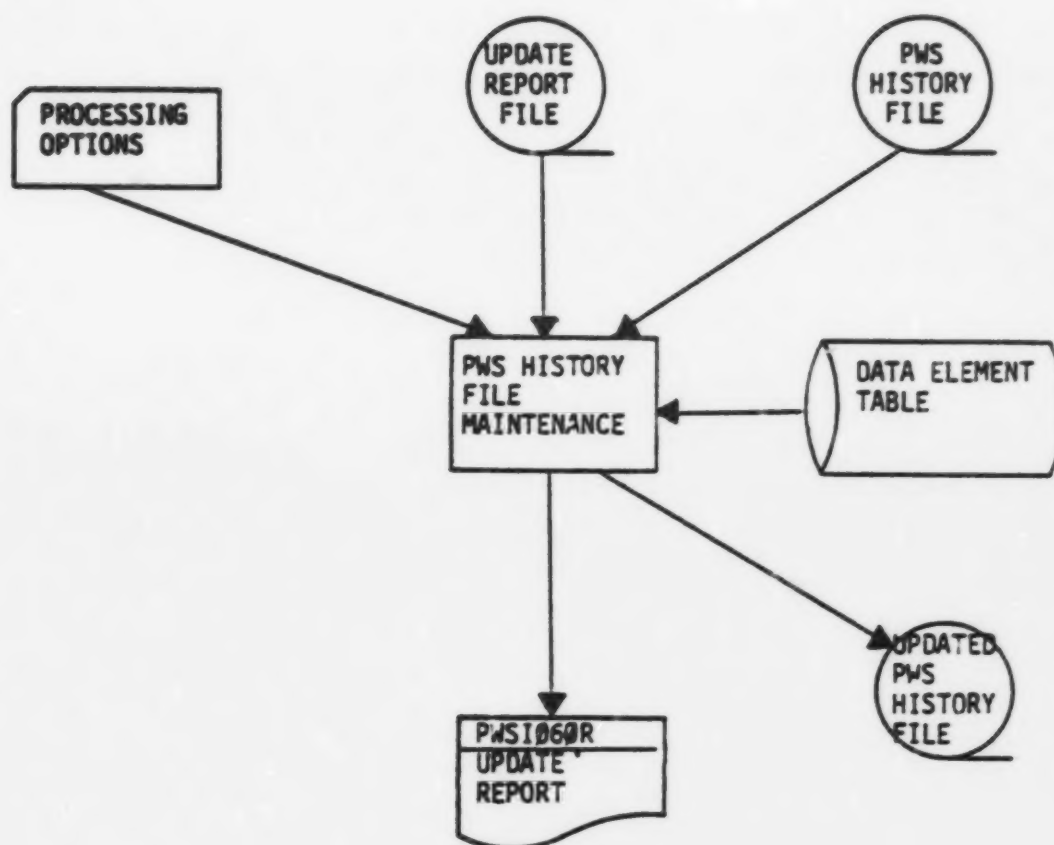
3. Outputs

- An updated version of the PWS History File.
- Report PWSI060R - Public Water Systems Inventory Update Report (Exhibit III.8).

4. Process

- Processing options are read and verified.
- Update records are sorted by PWS-ID.
- Update records are merged with the records of the PWS History File.
- The input selected for list (new records or the whole history file) is sorted according to the required sort parameters.
- The sorted file is listed.

FIGURE III.5
PWS HISTORY FILE MAINTENANCE



IV. WATER QUALITY COMPLIANCE SUBSYSTEM

A. Overview and Purpose

Two levels of PWS compliance with the Safe Drinking Water Act may be defined. The first or primary level of compliance is achieved by using those treatment, storage, and distribution methods needed to supply safe drinking water. A secondary compliance level is achieved by monitoring the quality of the drinking water being supplied to the public. This is a more indirect level and, therefore, less desirable method of detecting problems. Primary compliance actions are designed to prevent problems before they arise; secondary compliance activities are designed to identify problems and correct them after they arise.

Primary compliance can be controlled by a state in two ways:

- By a permit program for new PWSs; or
- By periodic sanitary surveys.

A permit program is essentially a sanitary engineering task. The PWS Inventory Subsystem will be used to maintain most data elements related to facilities. The Sanitary Survey Subsystem is used to schedule inspections of PWS facilities and thus provides a second way of controlling basic compliance.

Secondary compliance is accomplished by monitoring the sampling and analysis of finished water. The Water Quality Compliance Subsystem is designed to provide the means for this monitoring process.

There are eight requirements in the Primary Drinking Water Regulations that a PWS could violate:

- (1) Maximum Contaminant Level (MCL).
- (2) Sampling requirements: number, frequency, and methodology;
- (3) Check sampling;

- (4) State notification;
- (5) Public notification;
- (6) Treatment techniques;
- (7) Violation of a compliance schedule under a variance or exemption;
- (8) Record keeping.

The main purpose of the Water Quality Compliance Subsystem is to identify violations of the first three of these regulatory requirements. In this way, the Water Quality Compliance Subsystem compliments the PWS Inventory Subsystem and the Sanitary Surveys Subsystem by providing data management for tracking non-compliance with the Safe Drinking Water Act.

Secondary compliance can be further classified as compliance with the Federal Interim Primary Drinking Water Regulations or compliance with the state's own standards. There is a need to identify both, and also to indicate if non-compliance is temporarily overruled by variances or exemptions. The Water Quality Compliance Subsystem responds to this need by using the hierarchically structured Regulations Table and the PWSIF.

The main features of the Water Quality Compliance Subsystem are:

- Batch, sequential processing;
- Interaction with the PWS Inventory Subsystem;
- Independence from the data entry method chosen by a particular state;
- Simple control language for specifying selection criteria;
- Identification of violations of sampling requirements and water quality.

The subsystem will provide these benefits:

- Capability of scheduling sampling and reporting at PWSs;
- Most input data can be prepunched or preprinted, thereby reducing data entry problems;
- Maintenance of samples data;
- Identification of non-complying PWSs will enable the state to concentrate inspection and other efforts on those PWSs.
- The two-level violations identification relieves the state from special processing for reporting to EPA.

An overview of the Water Quality Compliance Subsystem is presented in Figure IV.1. The subsystem consists of five separate processes -- data entry, periodic summary, selection and analysis reporting, violations and scheduling -- each of which are described below.

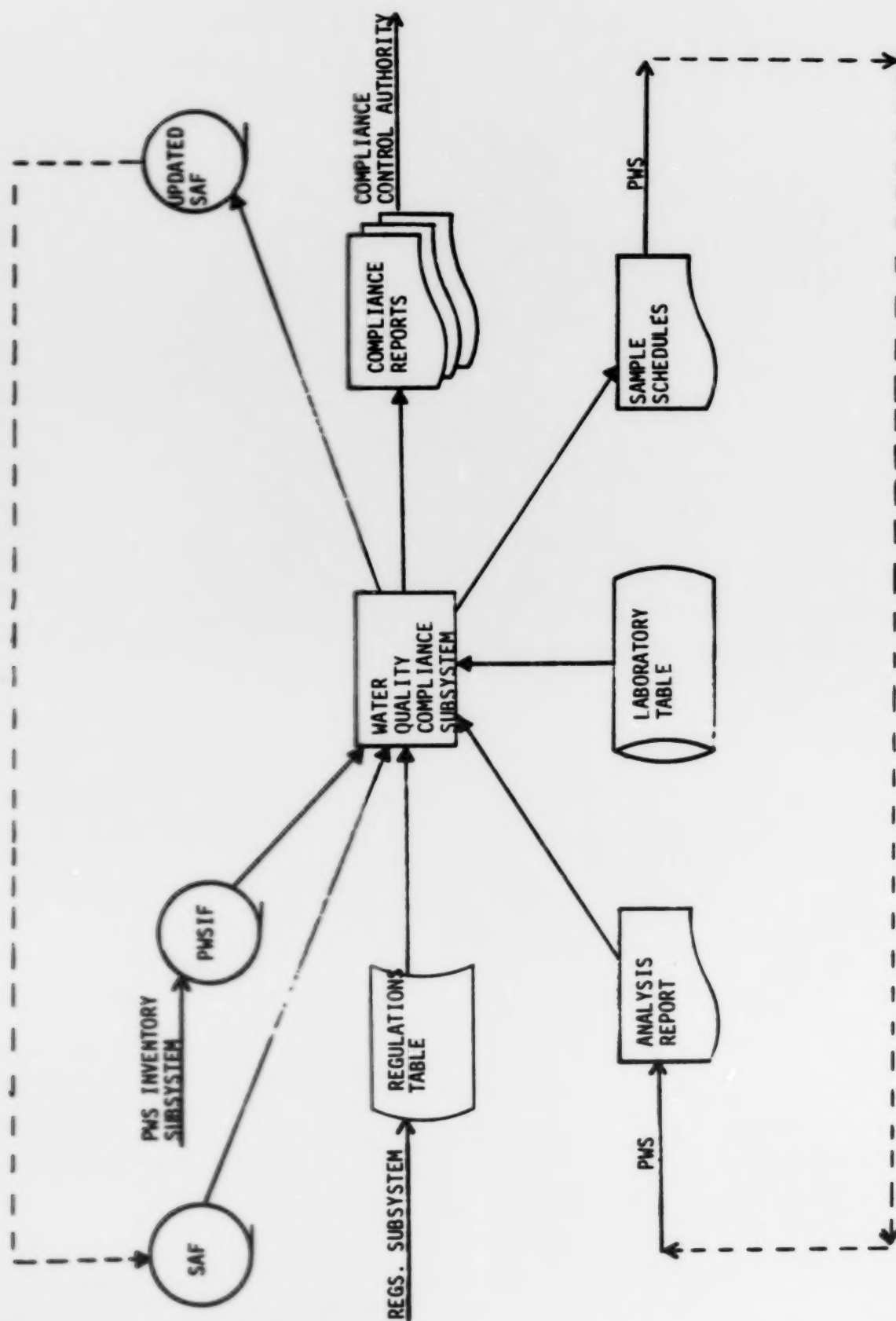


FIGURE IV.1
THE WATER QUALITY COMPLIANCE SUBSYSTEM

B. Compliance Cycle

It is anticipated that the new Federal Regulations will increase the number of samples currently taken every month for bacteriological and turbidity analysis by a large factor. As of now, estimates for individual states are from no significant increase to ten times as much.

In order to enable the states to overcome a "worst case" situation we introduce the concept of a "Compliance Cycle". If all PWSs had to sample by the same timetable, there would be a congestion of information at the end of the month that might create delay in processing it. To avoid this problem, the state must have the possibility of dividing the PWSs among several compliance cycles during the month. For example, if there are 3,000 community PWSs and 10,000 non-community PWSs, they can be divided into four compliance cycles during one month, each group containing 750 community PWSs and 2,500 non-community PWSs. For example, the compliance cycle for the second group could be the 40 days starting with the Monday of the second week of the month. In this way, the workload at the processing center will be more evenly distributed during the month. This design is based on the compliance cycle concept, and provides the capacity to input sample data as it is received and to summarize these data periodically according to a state determined schedule.

A state which does not desire to divide PWSs in this way would assign all of them to one compliance cycle.

C. Data Entry and Input Transactions

As mentioned above, the expected volume of input data to this sub-system requires attention to the methods used for entering the data. The bulk of the input will consist of results from bacteriological analyses, which can be recorded in three forms:

- Results of scheduled or unscheduled single samples;
- Results recorded on preprinted lists as scheduled by the system; and
- Summary reports.

Since individual states may choose any combination of the three methods, the data entry process is designed to be flexible to support all three methods; the system accepts individual transactions that can be input in any of the following modes:

(1) Keypunch: By this method, all data elements are keypunched onto cards (disk or tape). If the state uses prepunched cards as scheduling forms, the fixed information need not be punched every time. If a state uses list type reports, fixed information (such as PWS-ID, Contaminant-ID, etc.) needs to be punched only once per report and duplicated on the rest of the cards.

(2) On-Line: By this method, all data elements are typed on a keyboard terminal. If a state has a generalized on-line data entry facility which allows the terminal to be programmed as is possible with a keypunch machine, then the fixed data would need to be keyed in only once per list. However, the cost of a programmable machine is higher than the cost of one without this feature. If the on-line data entry device is not programmable, then the recurring cost will be higher than for keypunching because every data element will have to be keyed.

(3) Optical Character Recognition (OCR): By this method, a document is "read" by an OCR reader which can recognize preprinted information, markings, and handwritten digits. There is a variety of OCR equipment, with different capabilities. The equipment is expensive, but many states may already have it. Recurring costs of data entry would be lowest under this option, unless the error rate is high requiring a significant volume of keypunching of rejected OCR forms.

We think that each state should design the forms to be used according to the reporting and data entry methods that are available to it. Also, the keypunch method can always be used at the outset, and should be part of the subsystem, in any case, as a backup to the other, less widely used methods.

The three basic transactions in the Water Quality Compliance Subsystem -- sample data, violations, and deletions -- are discussed below.

1. Sample Data

As mentioned above, data may be entered for individual samples, or from a list of several samples, or the results may be entered in summary form. Exhibits in Volume II show prototype forms for all three modes of input and although these forms are presented as turnaround documents (that is, part of the information is preprinted by the system), the same design may be used as an input form only. It is anticipated that states will modify the prototype according to its format and regulations. The Water Quality Compliance Subsystem, however, expects all input transactions to be in the same structure (and keypunch columns) as those marked on the prototype forms; all transactions must be in the format of an 80 column punched card regardless of the method used for data entry.

The system is designed to accept three types of samples described below -- bacteriological, turbidity, and chemical and radiological samples.

a. Bacteriological Samples

Bacteriological samples may be reported by each PWS on a monthly summary form, a list of samples, or an individual sample form. If the reporting requirements flag is not set for a PWS, the Water Quality Compliance Subsystem will expect that a PWS taking less than 10 samples a month will report on individual forms, and 10 or more samples a month will be reported on a list. Exhibits III.20 to III.22 show the prototype format for each and the respective input transactions are as follows:

- (1) Transaction 'BS' - used to input results of a single bacteriological sample, and is keyed from the individual sample form or from a list.

- (2) Transactions generated from a monthly summary form are indicated by the analysis method used:

'MF' - Summary of analysis performed using the Membrane Filter.

'F1' - Summary of analysis performed using the Fermentation Tube Method with a standard portion of 10mm.

'F2' - Summary of analysis performed using the Fermentation Tube Method with a standard portion of 100mm.

'TB' - Summary information about samples analyzed by checking the free chlorine residual, and general type data.

b. Turbidity Samples

A PWS may report turbidity samples on a summary form or a list of individual samples (See Exhibits III.23 and III.24). The state may use the Turbidity Reporting Requirements Flag on the inventory record to indicate the reporting mode for each PWS. If the flag is not set, it is assumed that the PWS is reporting on a list. Individual states may modify the formats for turbidity reporting, and although these forms are designed as turnaround documents, they may also be used as input forms. However, the Water Quality Compliance Subsystem requires the structure of the input transactions to be in the specified format regardless of the data entry method.

The system determines the type of input for turbidity samples by the following transaction codes:

- (1) Transaction "TU" - is used to enter data for a single turbidity sample.
- (2) Transaction "TS" - is used to enter monthly summary data of turbidity samples.

Results of samples for chemical and radiological analysis must be reported individually. A prototype form, designed as a turnaround document, is presented in Exhibit III.19. This form contains only the contaminants included in the National Interim Primary Drinking Water Regulations; states may add more contaminants to its individual forms if desired. This transaction is identified by the code "CT" and the contaminant-ID.

2. Violations Data

Violations which are not automatically identified by the Water Quality Compliance must be reported using the Violation Reporting Form (Exhibit I.2). Transaction code '00' is used to create a violation record, and transaction code '01' to modify an existing violation record. Transaction '09' is used to delete a violation record, using the violation identification number.

3. Deletions

A sample on the Sample Analysis File (SAF) is identified by a unique sample key which is assigned during posting time, the PWS-ID, and Contaminant-ID. A sample record on the SAF is updated merely by deleting an existing record using the transaction code 'DT' (See Exhibit I.1) and then entering the modified transaction according to its type (e.g. bacteriological summary).

1. Overview

All input transactions are edited and posted to a periodic sample file which is used to collect and store data during the compliance cycle. Every reporting period, some of the data from the Periodic File will be summarized and posted to the Sample Analysis File (SAF). Errors detected during the process are handled according to standard MSIS error handling procedures.

a. Function - to validate input transactions, and post those which are valid to the Periodic File. This process is produced once or twice a week, according to the volume of transactions, and the schedule adopted by the state. Figure IV.2 displays the flow diagram for the data input module.

b. Inputs

- Processing options, including an indicator if a transactions list is to be produced, and the requested sort sequence;
- Transactions, both samples and deletions;
- The periodic sample file;
- The Laboratory Table; and
- The PWS Table.

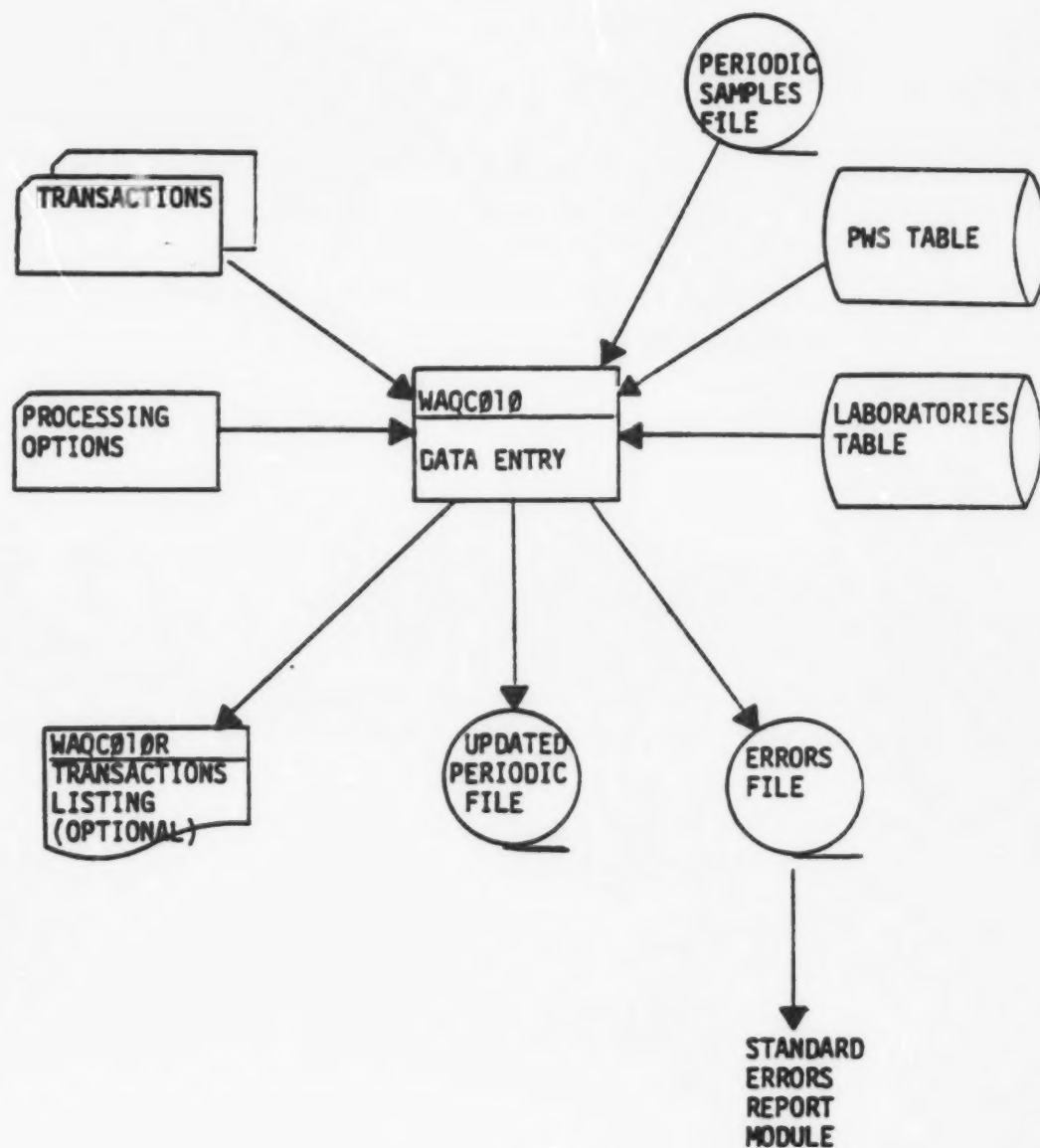
c. Outputs

- A file containing transactions in error, formatted according to the standard error handling feature of the MSIS.
- An updated periodic sample file.
- Report WAQC010R (Exhibit III.9), an optional transactions list, containing all valid transactions and showing the sequential number assigned to each transaction. This number will be helpful in locating a transaction on the file when the file is accessible by a text editor program (such as WYLBUR).

d. Process

- The processing options are read and verified;
- Transactions are read;
 - Sample data transaction is verified, including PWS-ID and Laboratory-ID.
 - A valid transaction, including a deletion transaction, is posted to the periodic sample file; if the option to list transactions is selected, the transaction is also written to a work file.
 - Transactions in error are posted to an errors file.
 - Upon reading all transactions, if a listing is required, the work file is sorted and then listed.

FIGURE IV.2

DATA ENTRY

1. Overview

The regulations require a large number of samples; for example, turbidity checks must be made daily at all PWSs using surface water. As a result, some PWSs will have to sample scores or even hundreds of samples each month. However, there is no need to keep a record for each individual sample, nor is this required by the regulations. Therefore, at the end of each compliance cycle, bacteriological and turbidity analysis sample data will be summarized, and only the summary records will be kept on the SAF. States electing to maintain a record of every sample taken could retain the periodic sample files for as long as they wish, but MSIS does not provide for further processing of their retained files. Results of chemical and radioactive analysis will be kept in detail because they are performed less frequently, and because this data is needed for research and planning.

The periodic summary process updates the SAF by reformatting and copying the results of chemical and radioactive analysis to the SAF; it also summarizes the results of bacteriological and turbidity analysis, and posts the summary records to the SAF. During the summary process, all violations of sampling requirements or MCL level are identified, and the appropriate reports are generated (see Appendix B for a discussion of violation identification). Each record posted to the SAF is assigned a sample-key composed of the Julian date of the processing day and a four-digit sequential number. A flowchart of the Monthly Summary Process is shown in Figure IV.3.

It should be noted that some samples may be missing due to lag time in mailing, data preparation or error correction. Therefore a PWS may be flagged as being in violation while it is actually in compliance. It is necessary, therefore, to allow enough time to pass between the end of the reporting period and the processing date in order to provide for entering most of the data. The length of this period will be different from state to state depending on the local procedures and conditions. Although this method will allow the capture of most of the samples, some will still be missing. The way to handle such cases is to maintain the SAF and the Violations File by deleting the appropriate records and inserting the correct data.

Check samples for bacteriological monitoring are not used to compute averages; therefore, they are not posted to the SAF during the summary process.

Bacteriological samples taken on a quarterly basis are copied to a new periodic file, and kept there until the quarter ends. Bacteriological and turbidity sample records of PWSs in other compliance cycles are likewise retained.

States which use their own laboratories and require notification of results to the PWS, can opt to create a PWS notification list or mail a copy of the reporting form as a notification.

The function, inputs, outputs and processing logic of the Periodic Summary module are detailed below.

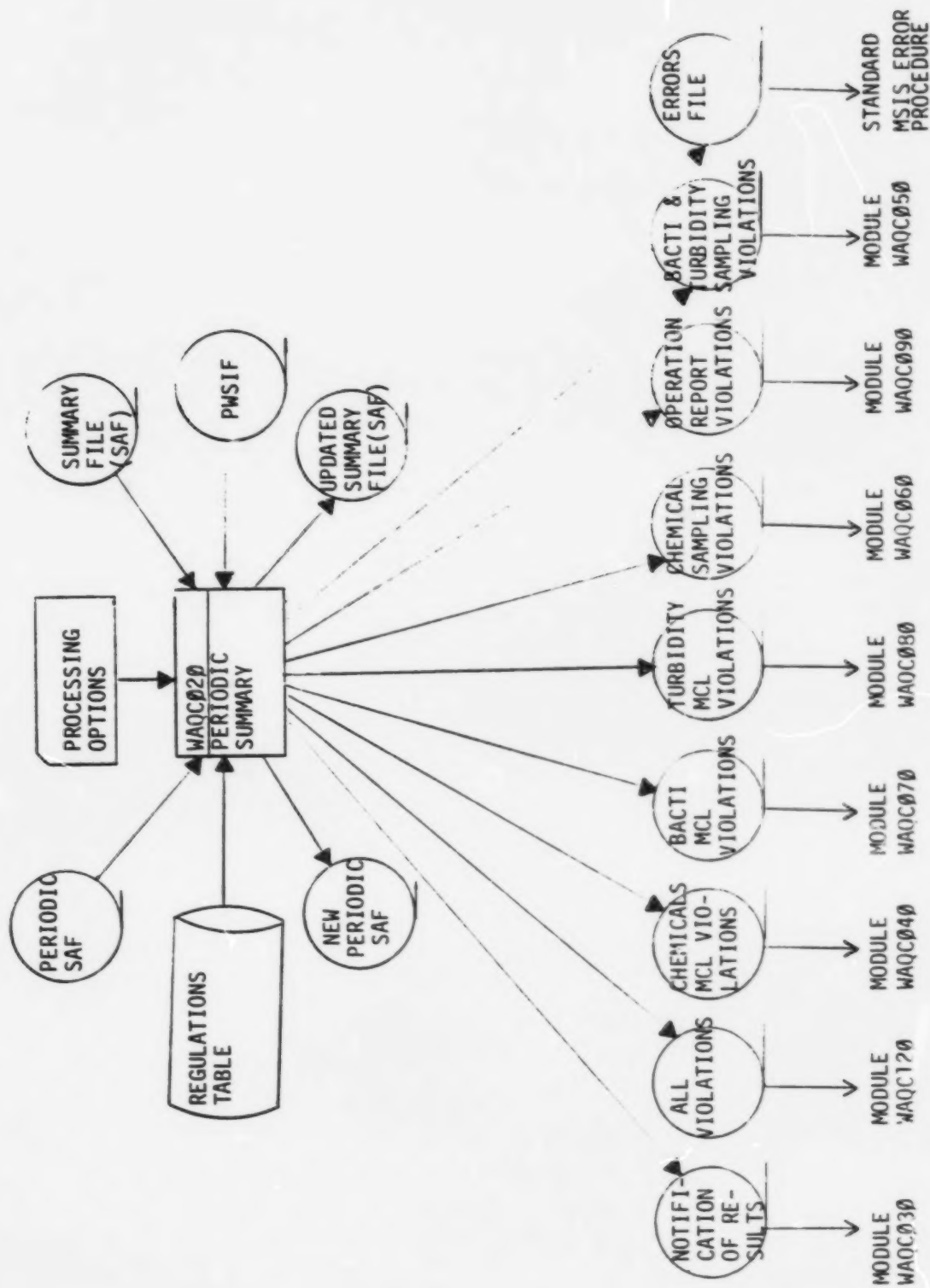


FIGURE IV.3

THE PERIODIC SUMMARY PROCESS

a. Function - to summarize the periodic file, as explained above.

b. Inputs

- Processing options, including:
 - Compliance Cycle to be summarized;
 - PWS notification option;
 - Option to produce a report of PWSs that did not submit an operation report.
- The regulations table;
- The periodic file, containing sample data gathered weekly (or daily) throughout the previous periods;
- The SAF;
- The PWSIF.

c. Outputs

- An updated version of the SAF;
- A new periodic file containing all sample data that was not summarized, copied, or dropped;
- An intermediate file containing data needed to produce a PWS notification (optional);
- An intermediate file containing data on all the violations that were identified. The data is formatted according to the format of a Violation Reporting Form (Exhibit I.2) without a Violation-ID. This file is used to update the Violations File;
- An intermediate file containing data on PWSs violating chemical and radiological MCL. This file is used to print the violations report WAQC020R (Exhibit III.10).
- An intermediate file containing data on PWSs which violated the bacteriological MCL. The file is used to print violations report WAQC050R (Exhibit III.13).
- An intermediate file containing data on PWSs which violated the MCL for turbidity. The file will be used to print violations report WAQC060R (Exhibit III.14).

- An intermediate file containing data on PWSs which violated the sampling requirements for chemical and radiological analysis. The file will be used to print violations report WAQC040R (Exhibit III.12).
- An intermediate file containing data on PWSs which violated the minimum sampling requirements for bacteriological or turbidity analysis. The file will be used to print violations report WAQC030R (Exhibit III.11).
- An error file.
- An intermediate file containing data on PWSs which did not submit the monthly operations report.

d. Process

- Processing options are read and checked for validity.
- The periodic file is sorted by PWS-ID, transaction code, contaminant-ID, sample date and sample type. The file is then read into the program.
- Individual bacteriological and turbidity samples of the current cycle and previous cycles are summarized. Violations of MCL standards and sampling requirements under both the state and federal standards are identified. Each violation causes a record to be written to the corresponding intermediate files, and the summary record is written to the SAF.
- Chemical and radioactive sample records are copied to the SAF unless a violation (according to the state regulations) is detected. A violation is confirmed if the average of the required check samples is larger than the MCL. If sufficient check samples have not been reported, and the check sampling period has not passed, the records are bypassed and retained in the periodic file. If the check sampling period has passed and the number of check samples is insufficient, then the sample violates both the MCL standard and the sampling requirements. Violations are written to the corresponding intermediate files, and each chemical or radiological sample that is not retained in the periodic file is copied to the SAF.

- If a deletion transaction is encountered for a record in the SAF, the record is deleted.
- If there is no corresponding sample record for a deletion transaction, the transaction is written to the error file.
- Every record posted to the SAF is assigned a sample key composed of a sequential number and the Julian date of the processing day.
- Transactions which are not posted to SAF are written on the new periodic file, except for bacteriological check samples that are dropped.
- If the notification option is elected, the appropriate records are written to the corresponding intermediate file. Note that each state electing to use this option must develop its own print program.
- Each PWS record is scanned and if a monthly operations report was not submitted, a record is written to the appropriate intermediate file.

To summarize, the Periodic Summary module creates several intermediate files that must be further processed to generate the required reports. These modules are described individually below; however, the detailed system design may incorporate several of these modules into single programs to ensure processing and operational efficiency.

3. PWS Notification - Module WAQC030

a. Function

- To print notices to PWSs advising them of the results from analysis made by the state. See flowchart in Figure IV.4. This module is optional and states may decide to notify the PWS through a copy of the laboratory analysis rather than a system generated report.
- Because the notification form will vary by state, this module should be coded and implemented by states electing to use it. It is mentioned here merely for completeness.

b. Input

- An intermediate file prepared by module WAQC020, containing data needed for preparing the notifications, in SAF Format.
- The PWS Table.

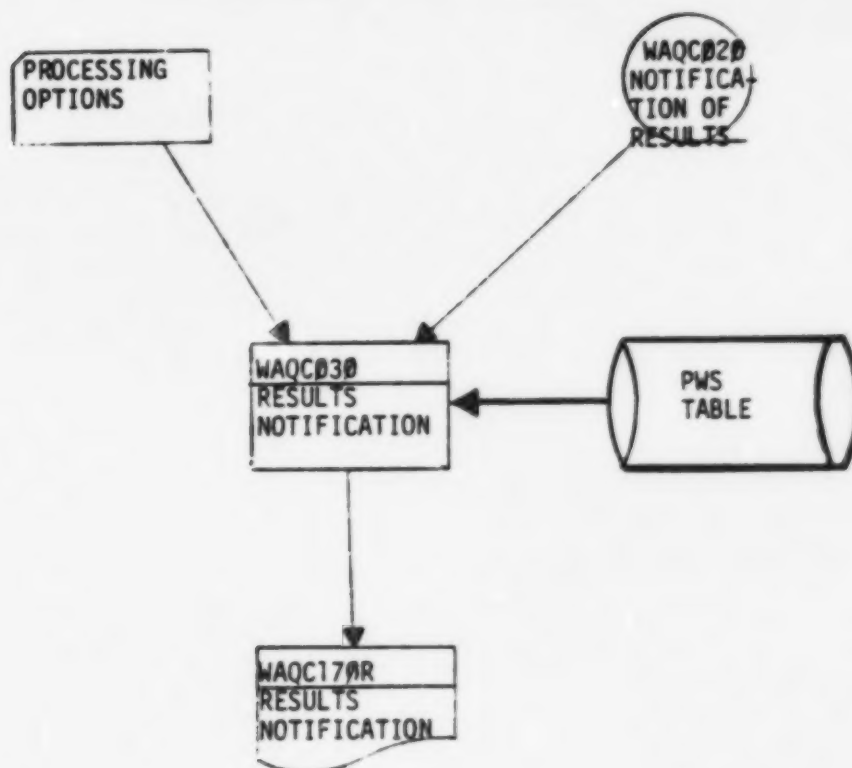
c. Output

- Notification of analysis results to PWSs. The notification form will differ from state to state. Some states will not notify the PWS and, accordingly, would not use this module.

d. Process

- The intermediate file is sorted by zip code, so that the notification can be mailed at bulk mailing rates.
- After the sort, the notification forms are edited and printed.

FIGURE IV.4
NOTIFICATION OF RESULTS TO PWSs



4. Listing Chemical and Radioactive Samples in Violation - Module WAQC040

a. Function

- To sort the intermediate file from Module WAQC020 and produce report WAQC020R. See flowchart in Figure IV.5.

b. Inputs

- Sort parameters;
- The intermediate file from module WAQC020, containing samples that were taken from the distribution system for chemical or radioactive analysis, and which are in violation of the applicable MCL.

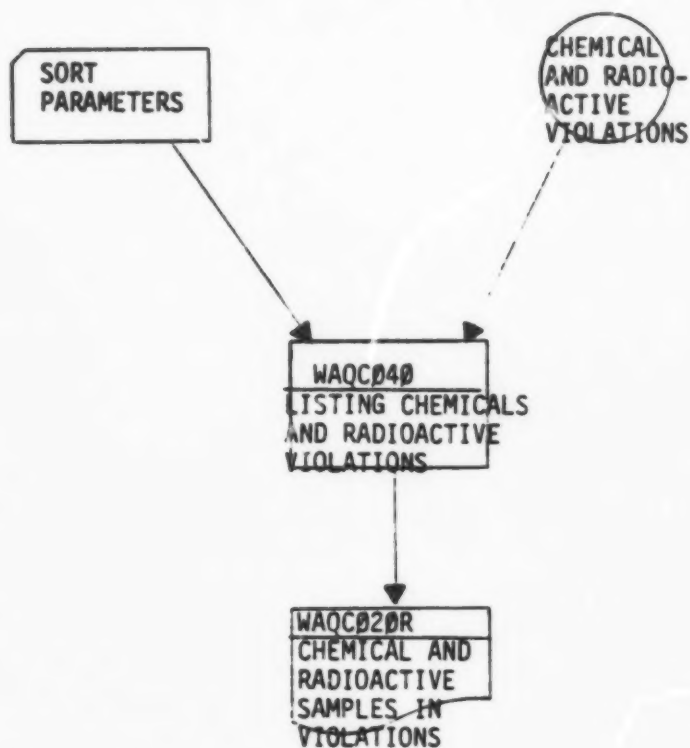
c. Output

- List of Samples in Violation of chemicals and radioactive standards - Report WAQC020R (Exhibit III.10).

d. Process

- The sort parameters are read and used to sort the intermediate input file.
- The sorted data is edited and printed.

FIGURE IV.5
CHEMICAL AND RADIOACTIVE SAMPLES IN VIOLATION



5. Edit and List PWSs Not Complying With Sampling Requirements -
Bacteriological and Turbidity - Module WAQC050

a. Function

- To sort the intermediate file created by module WAQC020 and edit and print report WAQC030R - Public Water Systems Not Complying With Sampling Requirements (Distribution System Sampling - Bacteriological and Turbidity). See flowchart in Figure IV.6.

b. Input

- Sort parameters.
- An intermediate file created by module WAQC020 containing the data for the report.

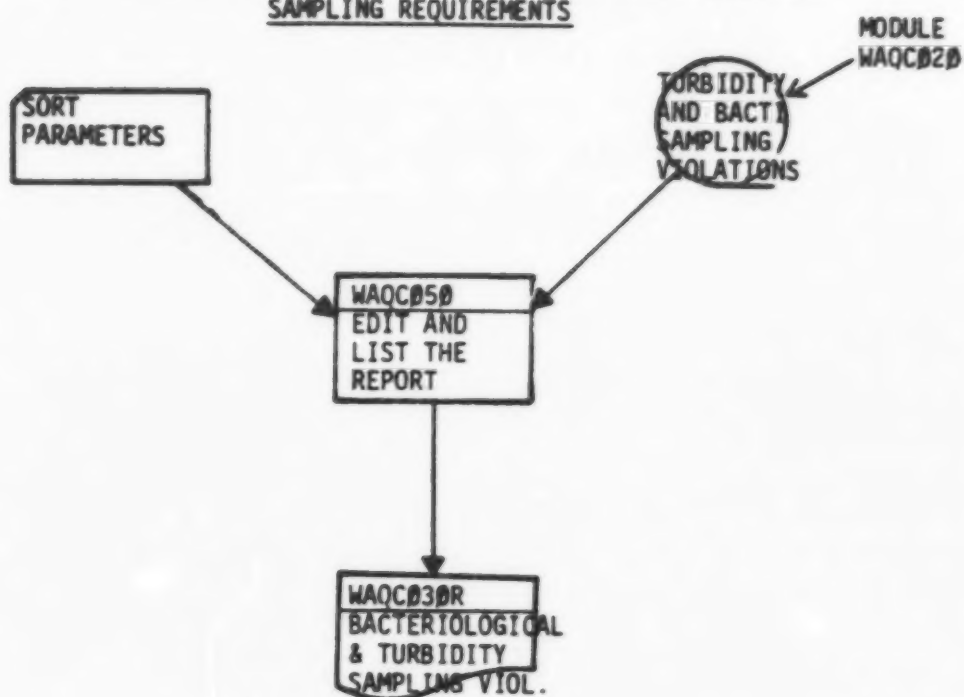
c. Output

- Report WAQC030R - Public Water Systems Not Complying With Sampling Requirements (Distribution System Sampling - Bacteriological and Turbidity) (Exhibit III.11).

d. Process

- Read and validate the processing options.
- The file is sorted according to the sort parameters.
- The report is then edited and printed.

FIGURE IV.6
PWS NOT COMPLYING WITH TURBIDITY AND BACTERIOLOGICAL
SAMPLING REQUIREMENTS



6. Edit and List PWSs in Arrears for Chemical and Radioactive Analysis -
Module WAQC060

a. Function

- To sort the intermediate file created by module WAQC020 and edit and print report WAQC040R - Public Water Systems in Arrears for Chemical and Radioactive Analysis. See flowchart in Figure IV.7.

b. Input

- The intermediate file created by module WAQC020 (The Periodic Summary) containing the data for the report.

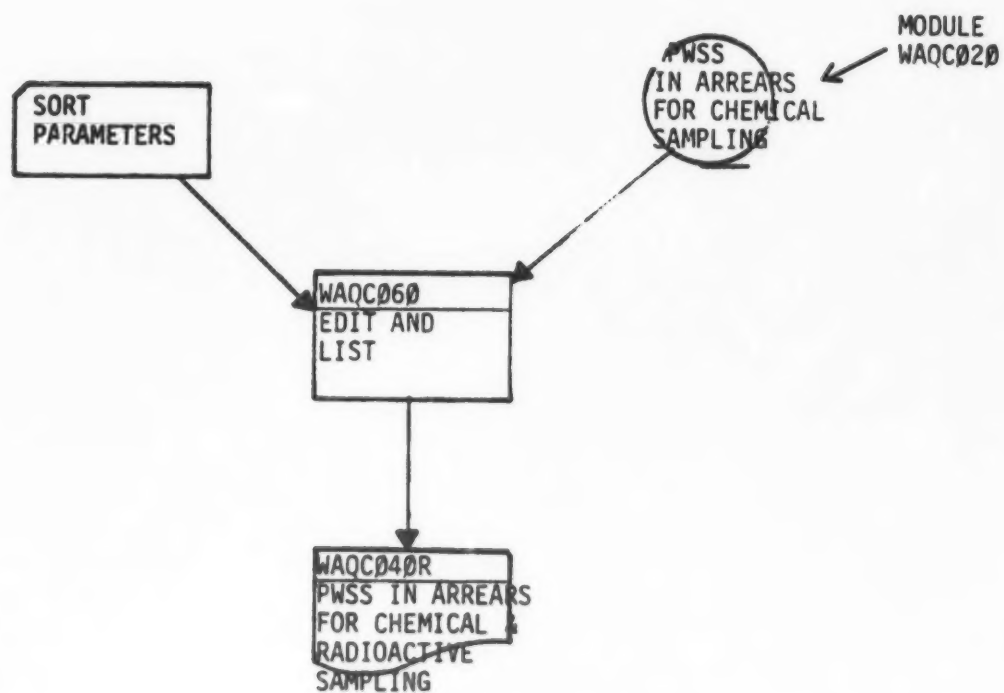
c. Output

- Report WAQC040R - Public Water Systems in Arrears for Chemical and Radioactive Analysis (Exhibit III.12).

d. Process

- Read and verify the sort parameters in the report.
- The input file is sorted according to the sort parameters.
- The report is then edited and printed.

FIGURE IV.7
PWSS IN ARREARS FOR CHEMICAL AND RADIOACTIVE ANALYSIS



7. Edit and List Summary of Bacteriological Analysis - Module WAQC070

a. Function

- To sort the intermediate file created by module WAQC020 or module WAQC100 (the selection module) and then edit and print report WAQC050R - Summary of Bacteriological Analysis. See flowchart in Figure IV.8.

b. Input

- Processing options; if the input file is prepared by module WAQC020 (the periodic summary) sort parameters would be part of the input, in which case the options may include sort parameters if the file is created by module WAQC100 (report selection), the first record on the file contains the sort parameters.
- An intermediate file created by module WAQC020 or module WAQC100 containing the data for the report.

c. Outputs

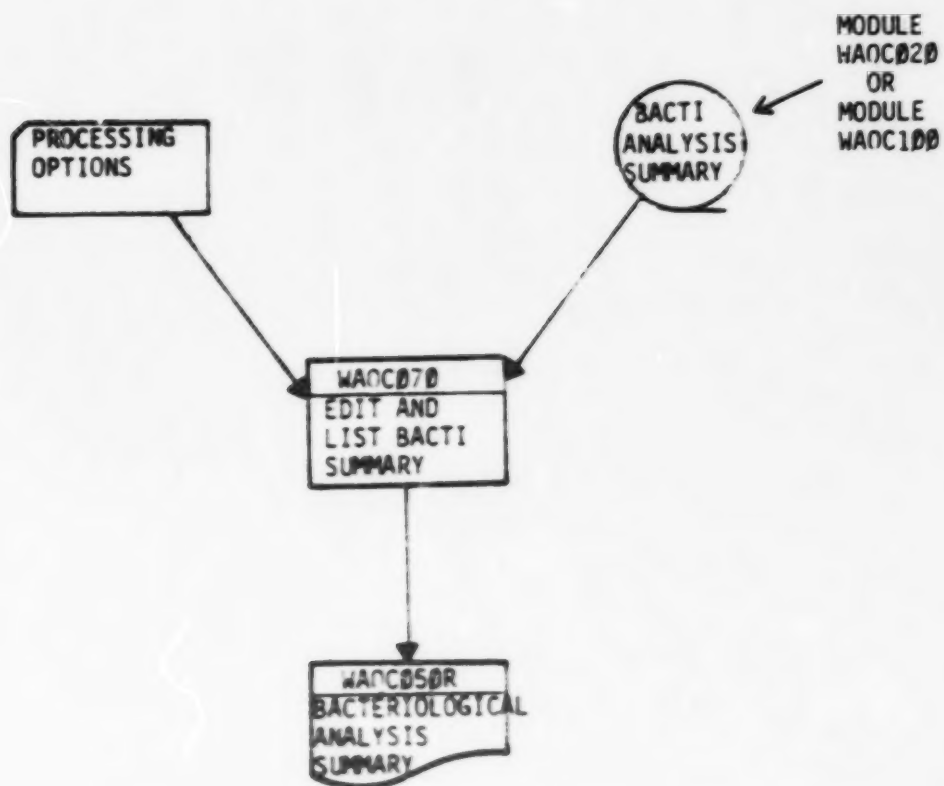
Report WAQC050R - Summary of Bacteriological Analysis (Exhibit III.13).

d. Process

- Processing options are read and verified.
- If the input file originated by module WAQC100, the first record is read from the input file to obtain the sort parameters for the report.
- The input file is sorted according to the sort parameters.
- The report is then edited and printed.

FIGURE IV.8

SUMMARY OF BACTERIOLOGICAL ANALYSIS



8. Edit and List Summary of Turbidity Analysis - Module WAQC080

a. Function

- To sort the intermediate file created by module WAQC020 or module WAQC100 and edit and print report WAQC060R - Summary of Turbidity Analysis. See flowchart in Figure IV.9.

b. Input

- Processing options; if the input file is prepared by module WAQC020 (the periodic summary) sort parameters would be part of the input; if the file is created by module WAQC100 (report selection), the first record on the file contains the sort parameters.

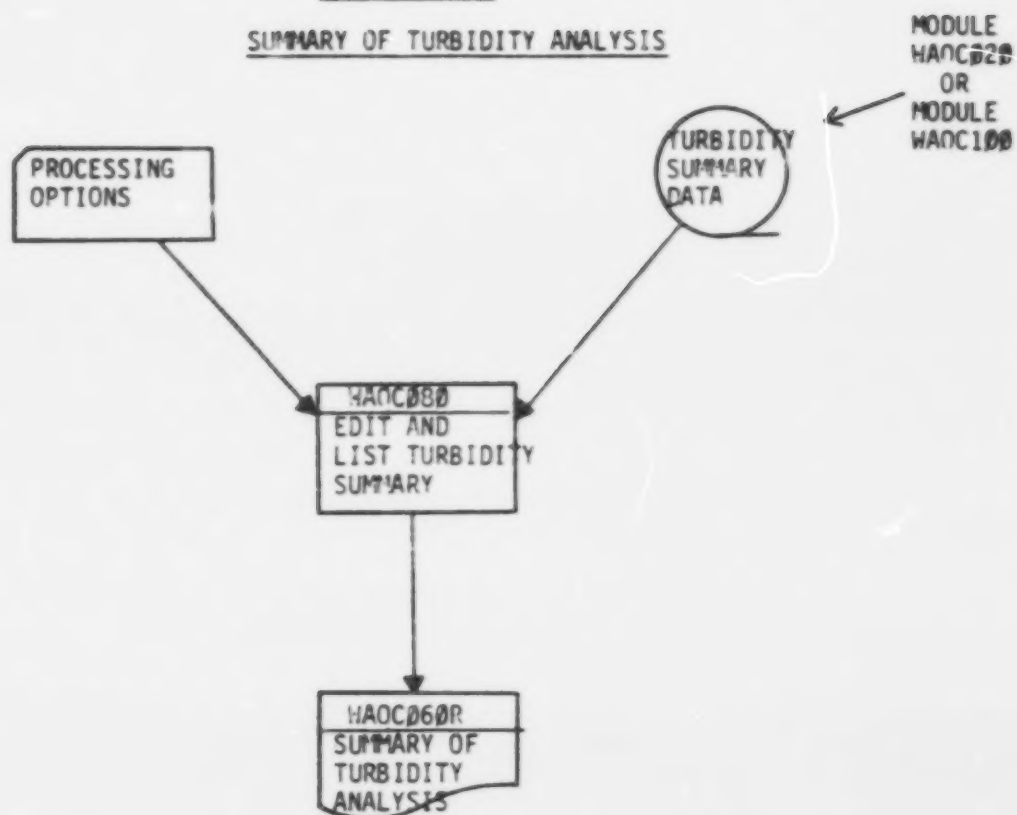
c. Output

- Report WAQC060R - Summary of Turbidity Analysis (Exhibit III.14).

d. Process

- Processing options are read and verified.
- If the input file is generated by module WAQC080, the first record is read from the input file to obtain the sort parameters for the report.
- The input file is sorted according to the sort parameters.
- The report is then edited and printed.

FIGURE IV.9
SUMMARY OF TURBIDITY ANALYSIS



9. Edit and List PWSs Late in Submitting the Monthly Operations Report -
Module WAQC090

a. Function

- To sort the intermediate file created by module WAQC020 and edit and list report WAQC070R - PWSs Late in Submitting the Monthly Operation Report. See flowchart in Figure IV.10.

b. Inputs

- Sort parameters.
- An intermediate file created by module WAQC020 (the periodic summary) containing the data for the report.

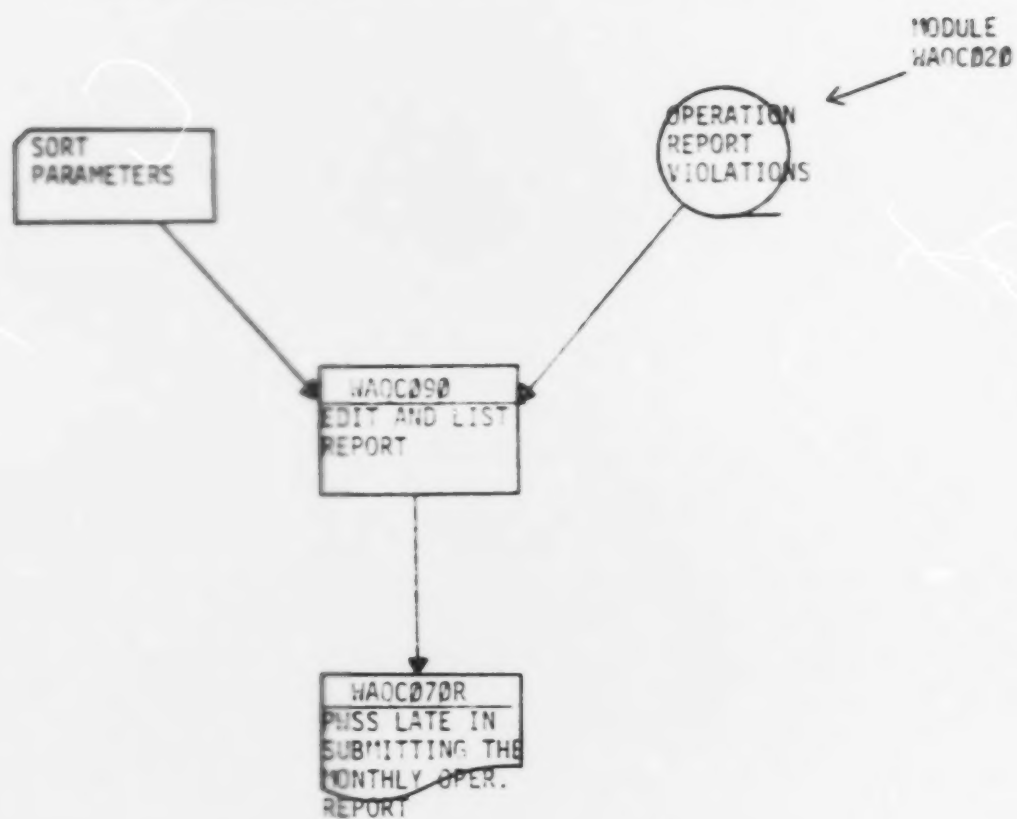
c. Output

- Report WAQC070R - Public Water Systems Late in Submitting the Monthly Operation Report (Exhibit III.15).

d. Process

- Read and verify the sort parameters.
- Sort the input file.
- Read the sorted file and list the report. When the sort is by region and district, skip to a new page whenever a region or district changes.

FIGURE IV.10

PWSS LATE IN SUBMITTING THE MONTHLY OPERATION REPORT

F. Analysis Data Reporting Process

1. Overview

The Data Entry Process and the Periodic Summary Process address violations data for the most recent compliance cycle. A state, however, has often the need to review results of analysis for a longer period of time and for a selected group of PWSs, including data on samples which did not violate the standard for MCL.

MSIS provides for entering sample data other than those from the water distribution system. These samples are merely written to the SAF, and since they are not checked for violations they are not displayed during the Periodic Summary Process.

In response to this need, the Analysis Data Reporting Process is designed to provide a state with the means to display selected analysis data from the SAF.

The process comprises two modules: One (WAQC100) for selection of data from the SAF, and the second (WAQC110) for listing chemical and radioactive analysis data. For similar analysis reports on bacteriological and turbidity samples, the selection module (WAQC100), extracts the required records from the SAF and modules WAQC070 and WAQC080 are used to print the respective reports. The flowchart of this process is contained in Figure IV.11.

The functions, inputs, outputs and processing of the modules in this process are described below.

2. The Reports Selection Module - WAQC100

a. Function

- To scan the SAF and select information to produce any of the three available reports according to the desired processing options. See flowchart in Figure IV.11.

b. Inputs

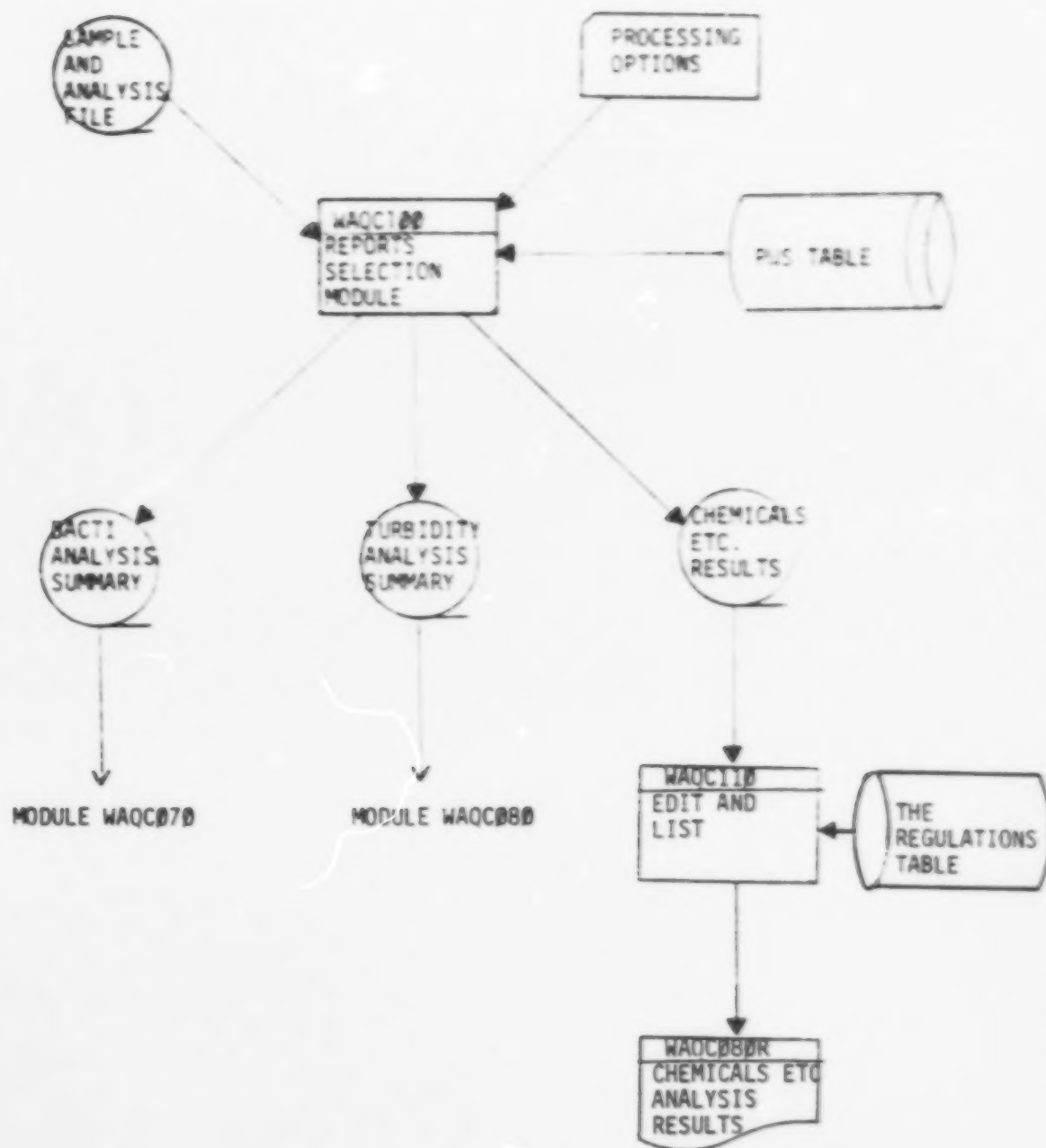
- Processing options:
 - reports to produce;
 - selection criteria;
 - relevant period for reports;
 - sort parameters for reports;
 - whether the summary of chemical and radioactive analysis report or a list of every sample is required;
- The SAF;
- The PWS Inventory Table, containing a few essential data about each PWS.

c. Outputs

- Intermediate files, containing information needed to produce any of the reports:
 - summary of bacteriological analysis;
 - summary of turbidity analysis;
 - results of chemical and radioactive analysis.

d. Process

- Processing options are read and checked for validity;
- The SAF is scanned for records containing data required to produce the various reports that were selected for production;
- Retrieved data is supplemented by PWS data from the PWS table, and then written on the appropriate intermediate file;
- The first record in each report output file is a header containing options for the report, as input via the processing options cards.



3. Edit and Print Summary of Chemical and Radioactive Analysis -
Module WAQC112

a. Function

- To sort the intermediate file prepared by module WAQC100 and edit and print report WAQC222 - Summary of Chemical and Radioactive Analysis. See flowchart in Figure IV.11.

b. Input

- An intermediate file created by module WAQC100 containing data on all samples that were selected for listing.
- The Regulations Table.

c. Output

- Report WAQC222 - Summary of Chemical and Radioactive Analysis (Exhibit III.18).

d. Process

- The first record in the intermediate file is read and sort parameters retrieved;
- The file is then sorted according to the desired sort sequence;
- For each selected PWS, samples and a summary line are listed for each contaminant;
- If the summary only option was selected, then for each contaminant the last sample and the summary line are listed.

G. The Violations Updating and Reporting Process

1. Overview

The input and compliance cycle processes of Water Quality Compliance Subsystem discussed so far identify violations of the water quality regulations in terms of non-compliance with maximum contaminant levels or with sampling requirements. This process maintains all violations, including those that are not identified by the system, on the Violations File; it also produces a Compliance Summary Report (WAQCI00R).

There are few data elements in a violation record. Therefore, there is no need for a complicated array of transactions. A new record is added using transaction '00' (Exhibit 1.2). Data elements to be included depend on the individual violation. They are:

- Violation identification
- PWS-ID
- Violation date
- Contaminant-ID
- Violation type
- Laboratory owner type
- Laboratory authorization status for the analysis method that had been used
- Analysis method used
- Results of analysis
- Number of required and received samples
- Remarks
- Code identifying if the violation is of primary or secondary, federal or state regulations

Transaction type '01' is used to update a violation record which has the same format as transaction type '00'; and transaction type '09' is used together with the Violation-ID to delete a record.

2. Violations Maintenance - Module WAQC120

a. Function

- To accept input transactions, verify them and update the Violation File with valid transactions. See flowchart in Figure IV.12.

b. Inputs

- Selection criteria, using the MSIS standard selection language;
- Update transactions (Exhibit I.2) prepared manually;
- Update transactions of violations identified by the Periodic Summary Module (WAQC020);
- The Violation File;
- The PWS Table.

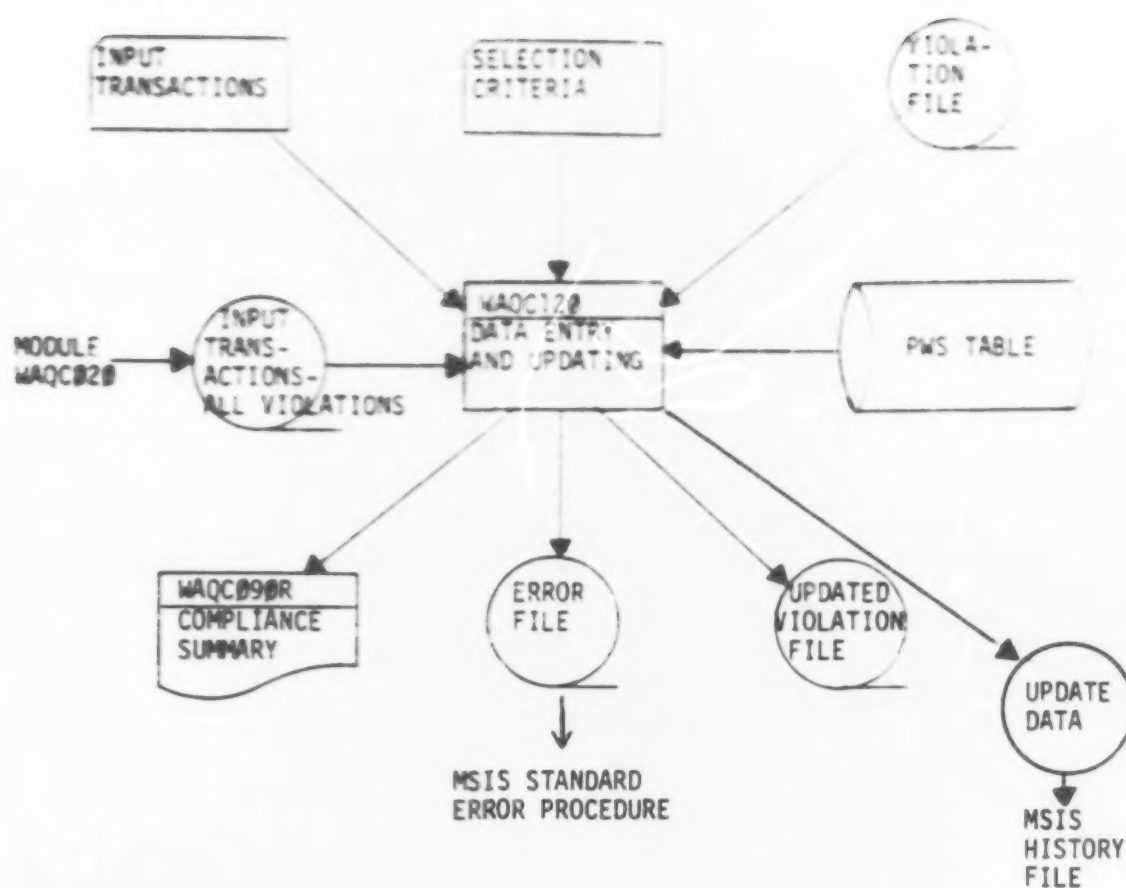
c. Outputs

- An updated version of the Violation File;
- An intermediate file containing transactions in error to be processed by MSIS standard error handling procedures;
- An intermediate file containing records for the preparation of the update report by the MSIS standard update report and history file procedure;
- Report WAQC090R - Compliance Summary (Exhibit III.17).

d. Process

- Sort manually generated transactions by their violation identification and transaction code.
- Validate verifiable data elements in every manually generated transaction. If any data element is in error, write the transaction to the errors file.

FIGURE IV.12 •
VIOLATION FILE MAINTENANCE



- Use valid data elements to update the Violations File:
 - If there is a record with the same Violation-ID as transaction '00', the transaction is in error and it is written on the errors file.
 - If there is not a record with the same Violation-ID, a new record is created, containing all valid data elements from the transaction.
 - If a record does not exist for a transaction type '01' or '09', it is an error, and the transaction is written on the errors file.
 - If a record exists for transaction type '01', the value for the relevant data elements is replaced, and a record is written on the update report file for each change.
 - If a record exists for transaction '09', the record is deleted from the file.
 - Transactions which were generated automatically by the Periodic Summary Process are treated as new violations (transaction code '00') and are assigned a Violation-ID number by the module.
 - Each of these new violations are listed on the report (the input file is generated by PWS-ID sort), with a summary per PWS.
 - Each violation record on the Violations File is scanned to see if it matches the selection criteria. If so, it is written to a work file.
 - At the end of the update process, the work file is sorted by PWS and the Compliance Summary Report is produced for the violations that were selected.

H. The Scheduling Process

1. Overview

The Scheduling Process is optional and its purpose is to prepare turnaround documents for reporting results of analysis and preparing mailing labels. This process will be useful to states which wish to notify PWSs the time and number of samples they must make and the type of analysis to perform. Mailing labels are another optional feature and are produced for shipping bottles for bacteriological analysis.

An additional and attractive feature is the option to prepare punched cards to help update the PWSIF when a monthly operation report is received by the state. Individual cards are punched for each of 12 monthly reports, and mailed to the PWS. When the PWS submits a monthly operation report, it submits the card for that month, which is used to update the PWSIF. The cards are in the format of transaction '06' (see Section III.A) for PWSIF update, containing the reporting month.

The Scheduling Process includes a scheduling selection module (WAQC130) which selects the PWS for sampling, and six modules to prepare the various turnaround documents. This process will be repeated for every compliance cycle to produce input forms for the next period.

2. The Scheduling Module - WAQ/C132

a. Function

- To scan the PWSIF according to the processing options and the Regulations Table, and produce intermediate scheduling files and operation report cards. See flowchart in Figure IV.13.

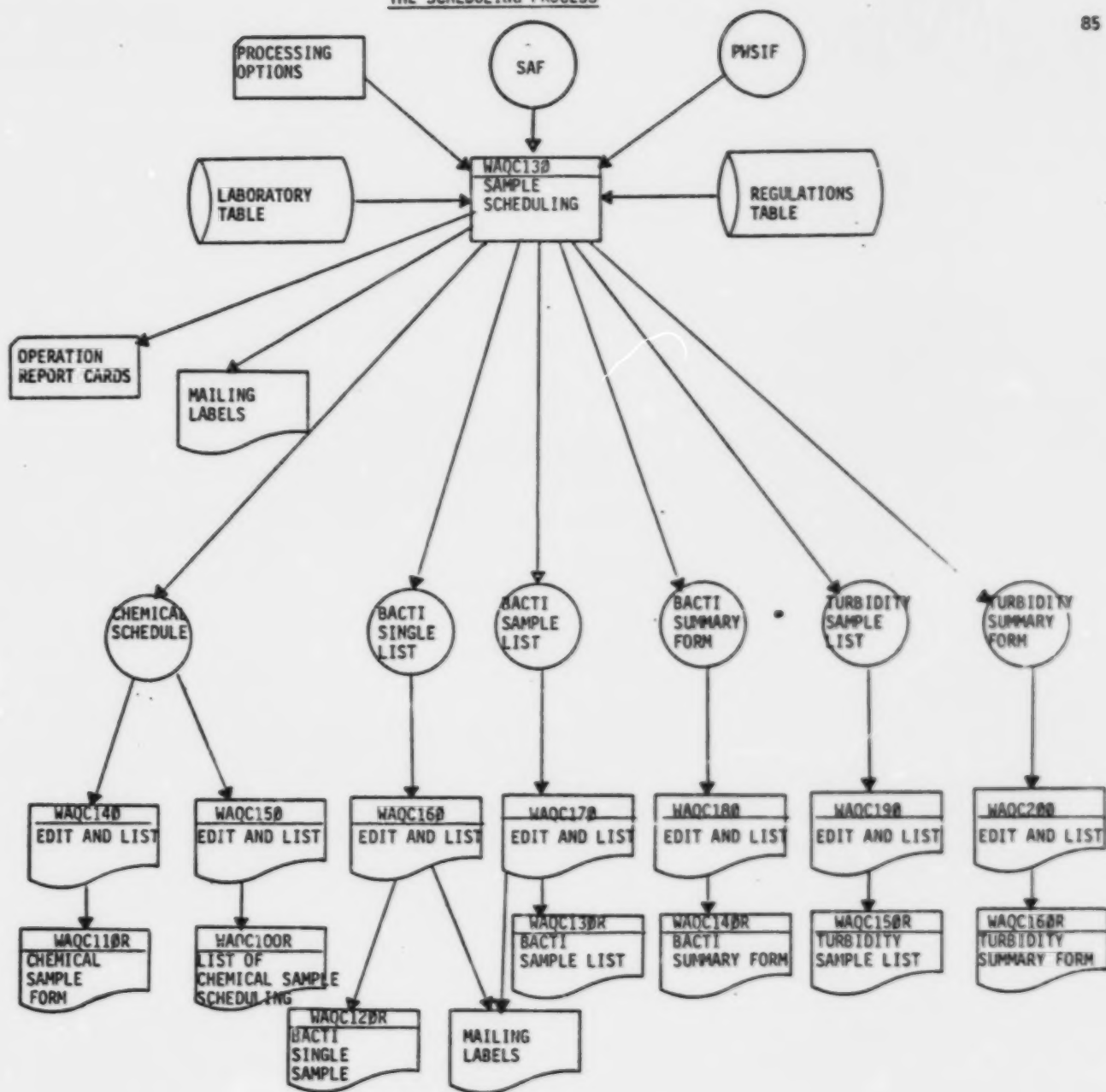
b. Inputs

- Processing Options:
 - the reports to produce
 - sort parameters for each report
 - the cycle to be considered for bacteriological sampling
 - reporting period for chemical and radioactive contaminants
 - period for which operation report cards are to be punched
 - print mailing labels for all PWSA
- The PWSIF
- The SAF
- The Regulations Table
- The Laboratory Table

c. Outputs

- Optional punched cards to indicate that the PWS has submitted its monthly operations report;
- Mailing labels to mail the above cards;
- Mailing labels to all PWSs.
- Intermediate file containing information for listing the scheduling reports:
 - chemicals and radioactive sample form;
 - list of PWSs for chemical and radioactive sample scheduling;
 - bacteriological single sample form;
 - bacteriological sample list;
 - bacteriological summary form;
 - turbidity sample list;
 - turbidity summary form.

FIGURE IV.13
THE SCHEDULING PROCESS



d. Process

- Processing options are read and verified.
- The options for each report are written as the first record on the correspondent intermediate file.
- The PWSIF is scanned for:
 - A PWS that must report analysis results for bacteriological samples for the next reporting period, and a record is written on the appropriate intermediate file according to the state regulations and the bacteriological reporting flag in the PWS record.
 - A PWS that must report analysis results for turbidity samples (for those on a monthly reporting cycle) and a record is written to the appropriate intermediate file according to the Turbidity Reporting Flag in the PWS record.
 - A PWS that must report results of chemical and radioactive analysis within a specified reporting period, and the required data is written to the appropriate intermediate file.
 - A PWS that requires additional prepunched cards to be submitted with the monthly reports and a number of cards are punched for the requested months, and a mailing label printed.
 - If a mailing label is requested for all PWSs, it is printed.

3. Chemical and Radioactive Sampling Schedule List - Module WAQC140

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC100R - Public Water Systems Scheduled for Chemical and Radioactive Analysis. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

- Report WAQC100R - Public Water Systems Scheduled for Chemical and Radioactive Analysis (Exhibit III.18).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.

4. Chemical and Radioactive Analysis Form - Module WAQC150

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC110R - Chemical Analysis Report Form. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

Report WAQC110R - Chemical Analysis Report Form (Exhibit III.19).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.

5. Bacteriological Sample Report Form - Module WAQC160

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC120 - Bacteriological Sample Report Form and Mailing Labels for bottle shipping. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

- Report WAQC120R - Bacteriological Sample Report Form (Exhibit III.20)*
- Mailing labels (optional).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.
- One mailing label per PWS. The number of bottles to be shipped is also printed on the label.

6. Report of Bacteriological Sampling and Analysis - Module WAQC170

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC130R - Report of bacteriological sampling and analysis and mailing labels for sample bottle shipping. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module and containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

- Report WAQC130R - Report of Bacteriological Sampling and Analysis (sample list) (Exhibit III.21).
- Mailing labels (optional).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.
- One mailing label per PWS; the number of bottles to be shipped is also printed on the label.

7. Summary of Bacteriological Monitoring Form - Module WAQC180

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC140R - Summary of Bacteriological Monitoring. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module and containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

- Report WAQC140R - Summary of Bacteriological Monitoring Form (Exhibit III.22).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.

8. Report of Turbidity Sampling and Analysis - Module WAQC190

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC150R - Report of Turbidity Sampling and Analysis. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module and containing the data needed to produce the output report. The first record on the file contains the sort parameters.

c. Output

- Report WAQC150R - Report of Turbidity Sampling and Analysis (Sample List) (Exhibit III.23).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.

9. Summary of Turbidity Monitoring Form - Module WAQC200

a. Function

- To sort an intermediate file created by the scheduling module (WAQC130) and produce report WAQC160R - Summary of Turbidity Monitoring. See flowchart in Figure IV.13.

b. Input

- An intermediate file created by the scheduling module and containing the data needed to produce the output report. The first record on the file contains sort parameters.

c. Output

- Report WAQC160R - Summary of Turbidity Monitoring Form (Exhibit III.24).

d. Process

- The first record is read and the input file is sorted according to the sort parameters.
- The sorted file is used to print the report.

A. Overview and Purpose

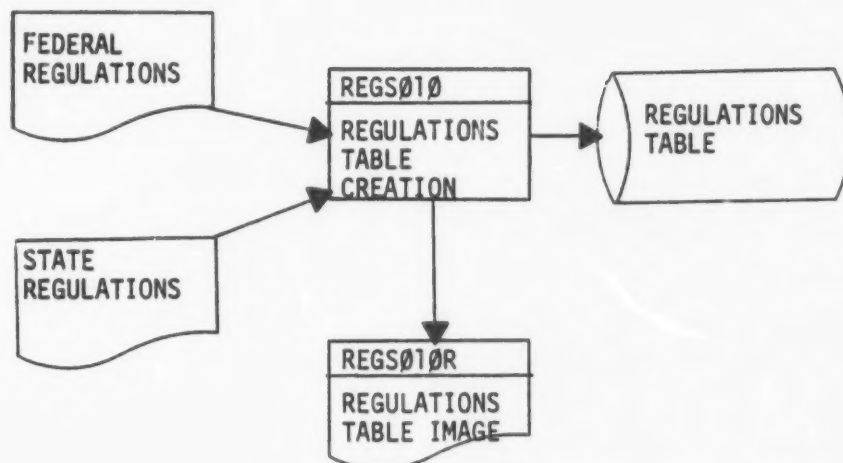
Drinking water quality is determined by comparing the results of laboratory analysis with the requirements of the Interim Primary Drinking Water Regulations. These regulations specify the extent of sampling types of analysis, and computation methods to be used. In some instances federal standards are modifiable by the states (for example, as in §141.27, using alternative analytical techniques). A state may also choose to enforce its own, more stringent standards, in which case, a PWS may be in violation of the state's standards, but not of the federal standards. In addition, a state may also grant variances and exemptions from both the federal and its own standards. In order to provide maximum flexibility in a computer system, this hierarchy of standards must be translated into a table format allowing computer programs to be driven by the table instead of fixed internal code.

This subsystem is designed to create the Regulations Table and list its contents. The Regulations Table is a file containing a record for every contaminant that is regulated. Each record indicates if the contaminant is regulated by the federal regulations or by state regulations. Where contaminants such as bacteriological contaminants are regulated by both state and federal regulations, state regulations are used for monitoring drinking water quality compliance, and the federal regulations are used to identify violations that must be reported to EPA.

The fundamental structure of the Regulations Table follows the National Interim Primary Drinking Water Regulations. If a state structures its regulations differently, the Table formats may not fit the structure of the state regulation and a special interface must be developed for that state. States may, however, add contaminants to the Table so long as the basic structure of the record is not violated.

The Regulations Subsystem consists of only one module (REGS010) whose function is to accept input transactions, create a Regulations Table file and list its contents. See flowchart in Figure V.1.

FIGURE V.1
REGULATIONS TABLE CREATION



The input consists of cards keypunched from the Regulations input forms (Exhibit I.3).

The output comprises the Regulations Table and Report REGSØLØR - Regulations Table Image (Exhibits III.25 through III.27).

The process consists of erasing the existing table, reading all input transactions, and creating a new table and listing its contents.

Since the regulations are expected to be fairly stable once established, the system need not provide individual record update capability. Each time a regulation is changed, data from the new set of keypunched cards replaces the old table. However, states that access to sophisticated text editors (like WYLBUR) may wish to maintain the table through such existing procedures.

VI. THE FEDERAL REPORTING SUBSYSTEM

A. Overview and Purpose

Section 142.15 of the Interim Primary Drinking Water Regulations specifies the reports that must be made to EPA by states who assume primary enforcement responsibility. These include:

- Additions or corrections to the national PWS inventory;
- All violations of the primary drinking water regulations and enforcement actions taken;
- Prompt reporting of any variance or exemption granted by the state;
- Annual report of the status of variances and exemptions.

The purpose of the Federal Reporting Subsystem is to retrieve data elements from the state's files, reformat them, and create a file for reporting to EPA. There is one module (FEDR010) that does all this. The features of the subsystem are:

- Batch processing of all the files in the system which are necessary for periodic reporting to EPA.
- Output is in the format required by EPA for reporting.

The potential benefits from implementing the subsystem are that states need not perform any special action for the routine annual report to EPA so long as they promptly record the granting of variances or exemptions. Execution of the Federal Reporting Subsystem will automatically produce all that is needed unless the Variances and Exemptions Subsystem or the Enforcement Actions Subsystem are not implemented, in which case their reporting must be done manually. This will save states using the Model State Information System the expense of preparing special summaries or input forms for EPA. On the other end, EPA will enjoy the benefit of standard formatted input forms for EPA. On the other end, EPA will enjoy the benefit of standard formatted input to its own data management system and the data will be more accurate and timely.

B. Creation of the Deviation File and the Modified PWS File - Module FEDR010

1. Function

- To match the PWSIF, VEF and the Violations File, and create a Deviation File and Modified PWS File. These two files constitute most of the annual reporting requirements. See flowchart in Figure VI.1.

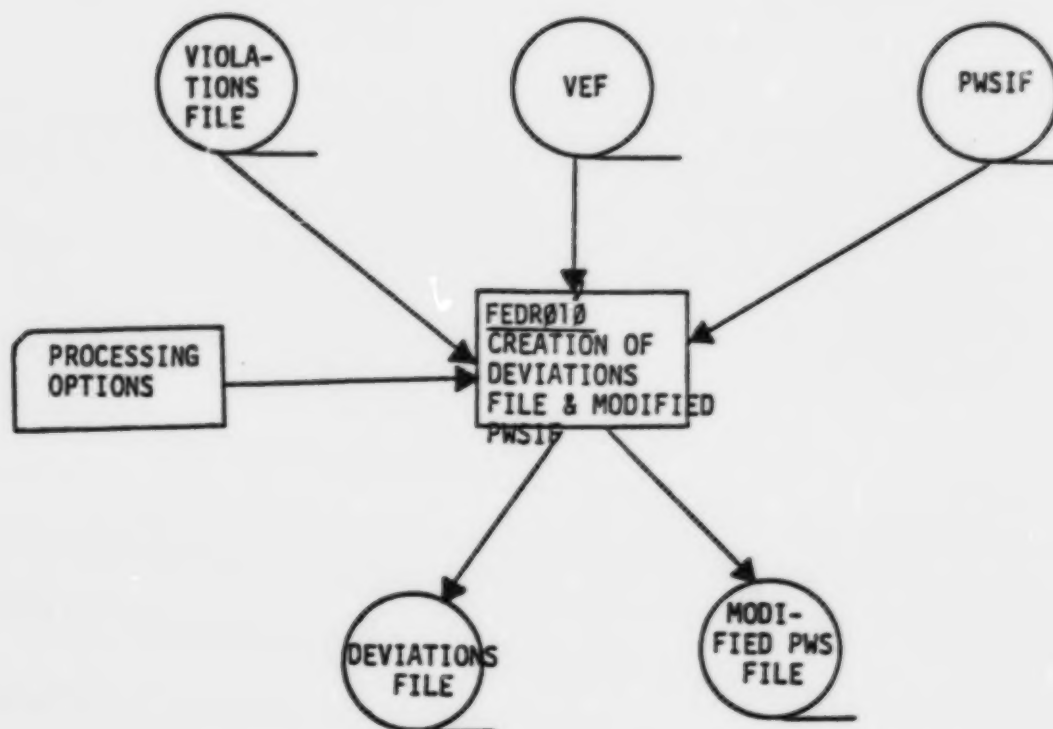
2. Inputs

- Processing options in which the reporting period is specified;
- The Violations File;
- The VEF;
- The PWSIF.

3. Outputs

- A file containing PWS records that were modified during the reporting period.
- The Deviations File containing records of violations and V & E's.

FIGURE VI.1
CREATION OF FILES FOR FEDERAL REPORTING



4. Process

- The VEF and the Violations File are sorted by PWS-ID.
- The PWSIF is scanned. If a PWS record was modified during the reporting period, it is copied in its entirety to the Modified PWS File.
- Records from the VEF and the Violations File are converted to the format of the Deviation Record and written to the Deviation File. Only samples or summaries that violate the federal regulations during the reporting period are converted or transferred to the Deviations File.

C. The Federal Reporting Process

The process of preparing files to report to EPA is composed of the following steps:

1. Update the Violations File with all violations that must be reported manually. (Module WAQC120) and produce report WAQC090R - Compliance Summary (Exhibit III.17) that covers the whole year (or other agreed reporting period).
2. Update the VEF with all current variances and exemptions data. Produce report VAEX030R - Variances and Exemptions Condensed List (Exhibit III.30).
3. Produce the Modified PWS File and the Deviations File (module REGS010). Use the Modified PWS File to produce report PWSI040R - Public Water Systems - Condensed Listing (Exhibit III.6). Thus, EPA would receive the latest status of any inventory record that was updated during the reporting period.
4. Copy the Enforcement Actions File, using a utility program, and use module ENAC030 to list the Case History of all enforcement actions.
5. The files that are required for reporting are ready, together with reports of their contents.
6. Copies of the reports which were produced may be made available for public inspection or required by 142.15(d) of the implementation regulations.

VII. THE VARIANCES AND EXEMPTIONS SUBSYSTEM

A. Overview and Purpose

States with primary enforcement responsibility are authorized to grant variances and exemptions (V&E's) from two types of requirements: maximum contaminant limits and required treatment techniques. The interim regulations do not contain any requirements with respect to treatment techniques; however, this type of requirement may be added at a later date when the interim regulations are revised. For states that have not qualified for primary enforcement responsibility, the EPA region is authorized to grant variances and exemptions.

Variances and exemptions may not be granted if to do so would result in an "unreasonable risk to health". EPA has indicated that this may be interpreted to mean that no variances or exemptions from bacteriological maximum contaminant levels should be permitted. Variances and exemptions, therefore, will probably be permitted only from the chemical contaminant levels.

Variances and exemptions both have essentially the same result. Both effectively exempt a public water system from one or more requirements of the regulations in the two specific areas noted above. The difference lies in the circumstances under which they may be granted and the length of time allowed for compliance.

(1) Variances

(a) A variance from a maximum contaminant limit may be granted if a public water system is unable to comply because it is unable to make its raw water source safe for technological reasons. For example, many water systems in the southern part of Virginia draw their water from sources containing a naturally high concentration of fluoride. These systems will probably have to find an alternative source of water either by building a new treatment plant at another location or purchasing their water from a safe supplier. Until they are able to locate an alternative source and build the necessary treatment facilities or locate a safe supplier, they will need a variance from the fluoride contaminant limit.

(b) A variance from a required treatment technique may be granted if a public water system can demonstrate that the treatment is not required because of the high quality of its raw water. In this case, the raw water is naturally free from a particular type of contaminant or contains low enough levels that it is unnecessary to treat it for that particular type of contaminant.

The first type of variance will be terminated when the system comes into compliance with the standard. The second type may be terminated at any time upon a finding that the nature of the raw water source has changed to the extent that treatment is required. In effect, both types of variances will be granted for indefinite time periods with no legislated termination date.

(2) Exemptions

Exemptions may be granted to public water systems that are unable to comply for compelling reasons, mainly economic ones. In other words, an exemption is designed to solve the problem of systems that cannot afford to apply available treatment technology rather than the problem of systems that cannot make their water safe with even the best available treatment technology. Exemptions address an economic problem; variances a technical problem. Unlike variances, moreover, exemptions cannot be granted for indefinite time periods. The Act itself states that compliance must occur by certain dates.

Exemptions are clearly aimed at the economic problems of smaller systems. The states (or regions) can use exemptions to give smaller systems additional time to comply with the regulations, but the Act contains specific cutoff dates by which these systems must be in compliance regardless of the cost.

If a variance or exemption is granted, the state (or EPA region) must prescribe a schedule for compliance and interim control measures within one year of the date it is granted. The state (or region) must monitor actual progress against this schedule in the same way that it has to monitor compliance with the main body of drinking water regulations.

The V&E subsystem must maintain V&E information for two purposes. First, this type of information is required by EPA. Second, information is required for monitoring progress against compliance schedules specified in particular variances and exemptions for particular public water systems.

An overview of the V&E subsystem is presented in Figure VII.1.

The main features of the V&E subsystem are:

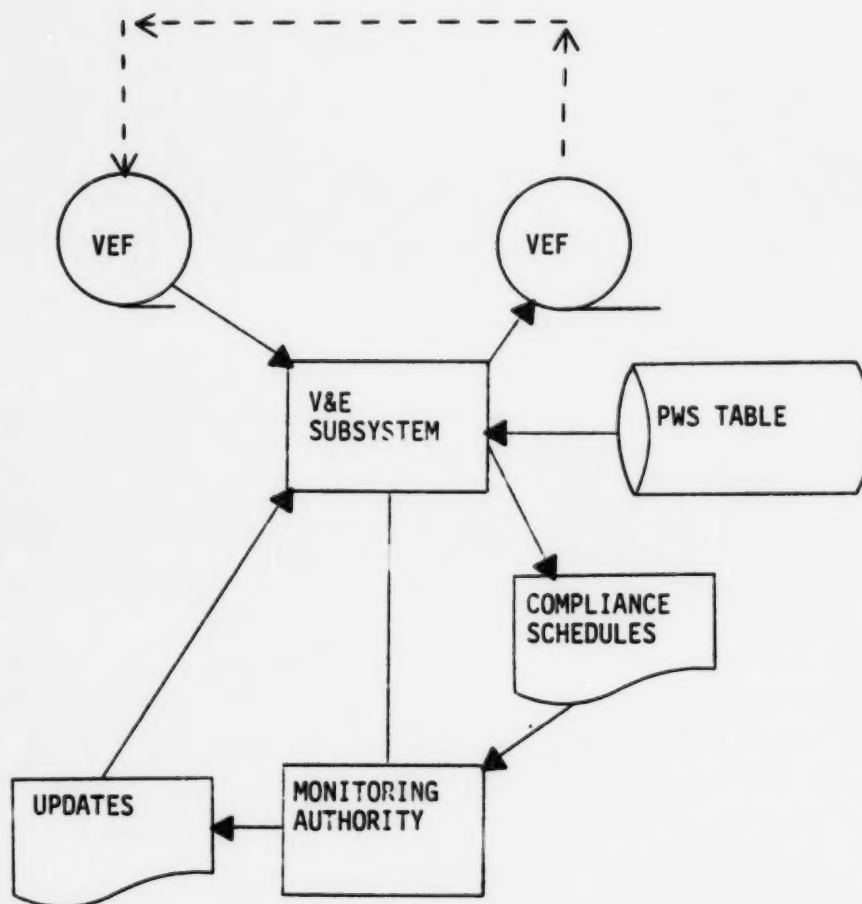
- Sequential, variable length file;
- Batch processing;
- Flexibility in reporting with respect to selection, sorting, and summarizing;
- Subsystem will be available as our optional feature.

The benefits resulting by using the V&E subsystem are:

- Supports systematic monitoring of V&E compliance schedules;
- Provides information required by the PWS Inventory and Water Quality Compliance Subsystems;
- Provides information required by the Federal Reporting Subsystem for reporting annually to EPA the status of all V&E's granted in the preceding calendar year.

FIGURE VII.1
THE VARIANCES AND EXEMPTIONS SUBSYSTEM

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Transactions to create and maintain the Variances and Exemptions File (VEF) are in the format of an 80-column punched card. The source of transactions is the administrative unit responsible for the granting and monitoring of variances and exemptions.

All V&E's on the VEF are identified by a sequential identification number. Accordingly, transactions refer to a V&E record by that number in columns 1 to 5. There are three types of transactions: addition of a new V&E record, changes to data elements in an existing record, and deletion of an existing record. All transactions are identified by a two-digit transaction code in columns 6 to 7. The transaction key columns 1-7, is a combination of V&E-ID and transaction code. See input forms layout in Exhibit I.4.

1. Addition of a new record

This transaction contains an identification number and transaction code '00'. It will cause creation of an empty V&E record. All other data is then added through a change transaction.

2. Change transactions

After a V&E record is created, it is maintained through a series of change transactions described below:

- a. Transaction code '01' can be used to change the values of these data elements:
 - Reference V&E identification;
 - PWS-ID;
 - V or E indicator;
 - Effective and Expiration Dates;
 - V&E status code;
 - V&E reason code;
 - Contaminant-ID;
 - MCL;
 - Treatment Code; and
 - Alternate treatment code.
- b. Transaction codes '02' to '11' can be used to enter or change up to ten lines of 49-positions each, containing an abstract of the case.
- c. Transaction code '20' can be used to add a milestone to the compliance schedule associated with the V&E. A milestone is identified by its target date in columns 8 to 13. For each additional milestone, a milestone code must be input in addition to the target date. A milestone may be repeated periodically (such as notifying the public every three months), in which case, the first target date is retained and the number of months is entered in the repeating milestones field.
- d. Transaction codes '21' to '23' are used for entering up to three lines of 49-positions each, for an abstract of the milestone.
- e. Transaction code '24' can be used to report the actual date the milestone was reached and/or a reason code for a delay in completion by target date. A milestone cannot be deleted from a V&E record. Rather, a delay reason code "milestone abolished" will be entered with the corresponding actual date.

- f. Transaction code '99' is used to delete an existing V&E record. Prior to deletion, the status code must be set to "record awaiting deletion". In this way, erroneous deletions can be reduced to a minimum.

C. Data Entry and Updating - Module VAEX010

1. Function

- To accept input transactions into the V&E subsystem, validate them and update the VEF.
- To create transactions to update the PWSIF and to create files for producing routine reports.

Individual states would establish a schedule for the subsystem; for example it may be run monthly or bi-weekly, depending on the amount of data to be processed. Figure VII.2 shows a flowchart of the Data Entry and Update module.

2. Inputs

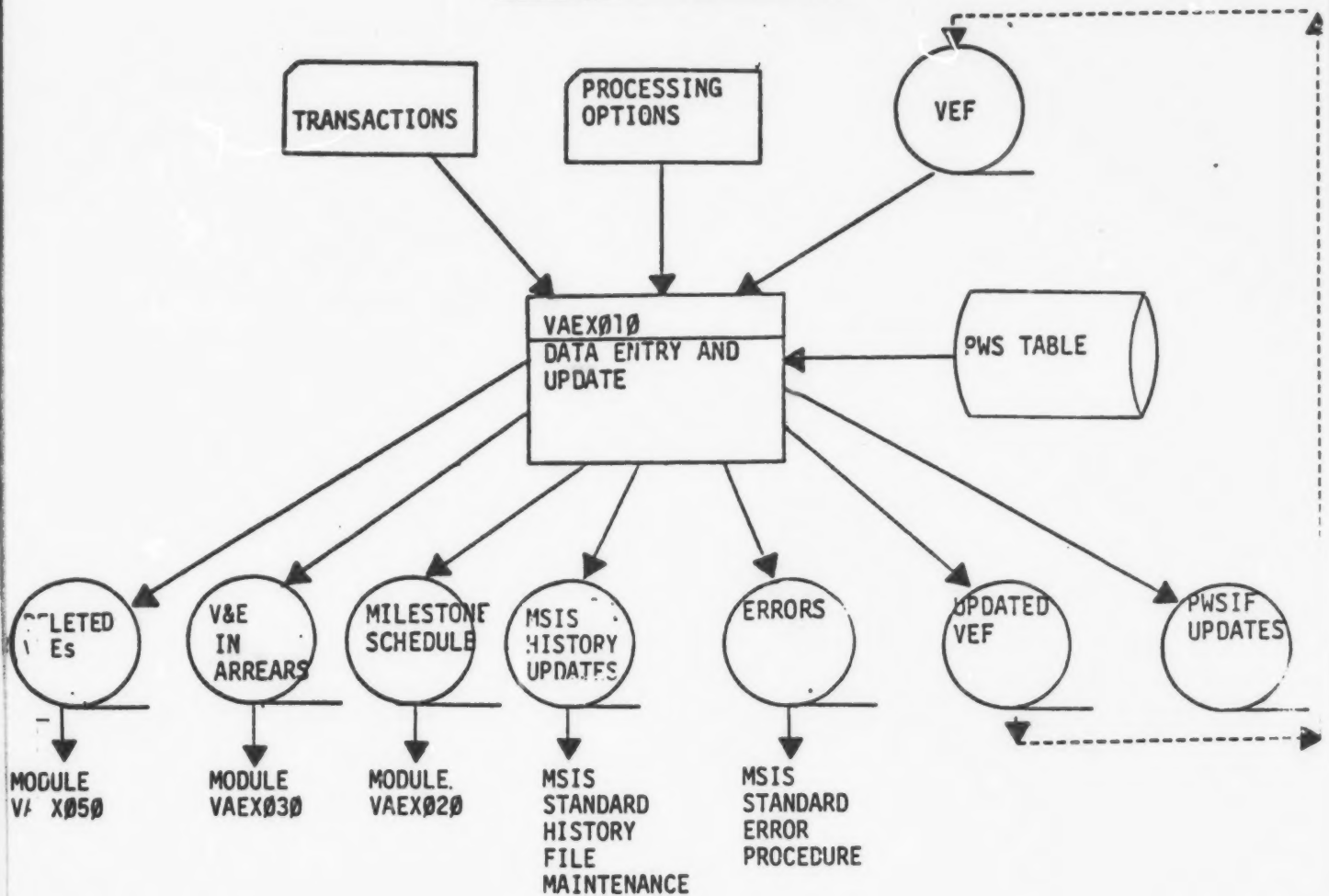
- Processing option, containing a periodic request for the compliance schedule report,
- Input transactions,
 - The VEF,
 - The PWS table.

3. Outputs

- An updated version of the VEF,
- Transactions to update V & E information in the PWSIF,
- Errors File, to be processed by the standard MSIS errors reporting and corrections process,
- An intermediate file containing records for producing the update report.
- An intermediate file containing information for printing report VAEX010R - Compliance Schedule
- An intermediate file containing information for printing report VAEX020R - Compliance Schedule in Arrears
- An intermediate file containing V & E records deleted from the VEF. The records will be printed by a subsequent module.

FIGURE VII.2
V&E DATA ENTRY AND UPDATING

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4. Process

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- Processing options are read and verified;
- The transactions are sorted by V & E identification, transaction code, and target date.
- All transactions are checked for validity as they are read, and an invalid transaction is written to the errors file.
- Valid transactions are matched against the VEF.
 - If transaction is an addition and a V & E record already exists - it is written on the errors file;
 - If transaction is an addition, and a V & E record does not exist, it is created.
 - If it is a change or delete transaction and a corresponding V&E record does not exist, the transaction is written to the error file.
 - If a V&E record exists, it is appropriately updated and a record is written to the MSIS History update intermediate file.
 - Deletions can be made only if the V & E status was previously set to - "awaiting deletion." If so, the V & E record is deleted from the VEF and written on an intermediate file, and an appropriate record is written to the MSIS history update file. If not, the deletion transaction is written to the errors file.
- After each record has been updated, the last update date is modified.
- Every V & E record is checked. If a milestone target date is overdue, a record is written on the intermediate file for compliance schedule in arrears. If any target date is due within the period specified in the processing options, (default period is next month), a record is written on the intermediate file to produce the compliance schedule report. The first record on that file contains the period covered by the report.

D. Compliance Schedule Listing - Module VAEX020

1. Function

- To sort the intermediate file containing the compliance schedule information, and list report VAEX010R. See flowchart in Figure VII.3.

2. Input

- An intermediate file, created by module VAEX010, containing the records of V&E's that are due to comply with a certain milestone by target date. The first record on the file contains the relevant period ('from' date and 'to' date).

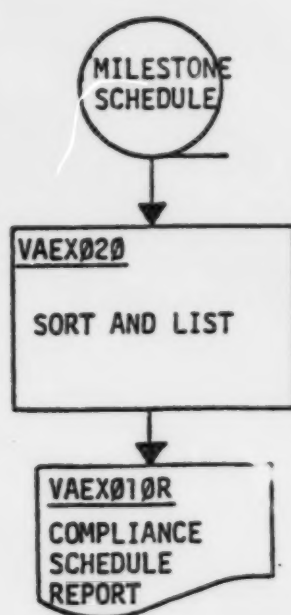
3. Output

- Report VAEX010R - Compliance Schedule for the period xx/xx/xx to xx/xx/xx (Exhibit III.28).

4. Process

- The intermediate file is sorted by region, district, and PWS-ID.
- The first record is read, the "TO" and "FROM" dates are used to modify report headline.
- All records are read and listed. If a PWS has several target dates within the period, they are listed in ascending order.

FIGURE VII.3
COMPLIANCE SCHEDULE LISTING



E. Compliance Schedule in Arrears Listing - Module VAEX030

1. Function

- Sort the intermediate file containing the data, and list report VAEX020R. See flowchart in Figure VII.4.

2. Input

- An intermediate file, created by module VAEX010, containing records of V&E's that did not comply with the compliance schedule target dates.

3. Output

- Report VAEX020R - Compliance Schedule in Arrears (Exhibit III.29).

4. Process

- Sort the intermediate file by target-date, region, district, PWS-ID
- Read sorted records and list the report. If several target dates were not met by a PWS, they are listed in ascending order.

FIGURE VII.4
COMPLIANCE SCHEDULE IN ARREARS LISTING



F. Retrieval and Condensed Listing - Module VAEX040

1. Function

- To scan the VEF and retrieve V&E records as specified by selection parameters. Two reports can be selected - condensed list or a case history. The condensed list is produced by this module, and an intermediate file is prepared for case history reports. See flowchart in Figure VII.5.

2. Inputs

- Selection and sort parameters using the standard MSIS selection language (See Section II.C).
- The VEF.
- The PWS table.

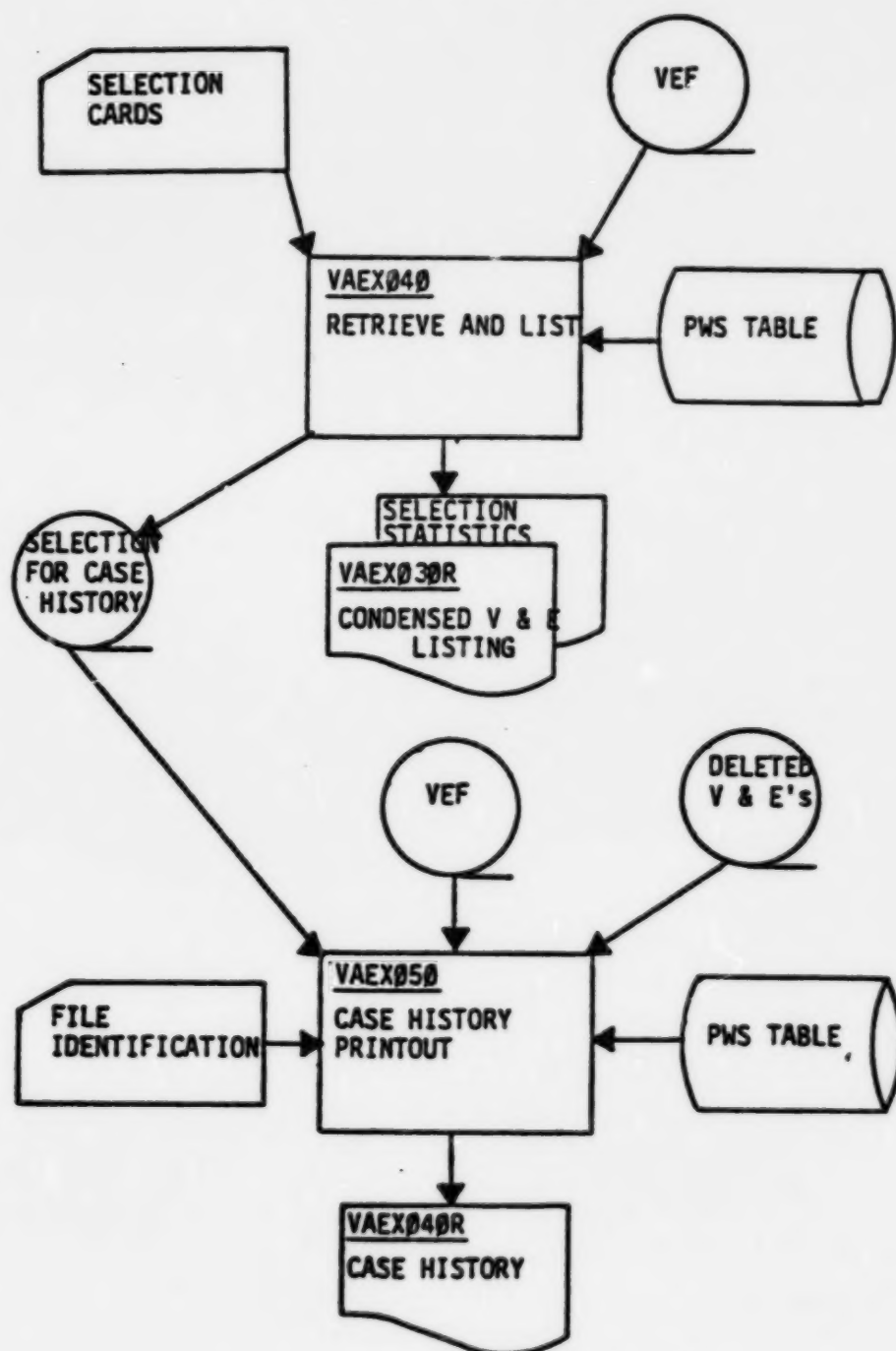
3. Outputs

- Selection statistics and diagnostics report.
- Report VAEX030R - Variances and Exemptions Condensed List (Exhibit III.30).
- An intermediate file containing V&E records selected for case history printout. The first record on the file contains sort parameters.
- Selection statistics report (to be designed during the detail design phase).

4. Process

- Selection parameters are read and verified, and sort parameters for the case history report are written on the intermediate file.
- The VEF is scanned, and every V&E record is matched against selection criteria.
- If a record matches the selection criteria for the condensed list, it is written on a work file.
- If a record matches the selection criteria for the case history file, it is written on the intermediate file.
- When the VEF is exhausted, selection statistics are printed.
- If any data was selected for the condensed list, the work file is sorted by the sort parameters and then read and listed.

FIGURE VII.5
RETRIEVAL AND CONDENSED LISTING
AND CASE HISTORY PRINTOUT



G. Case History Printout - Module VAEX050

1. Function

- To print the case history report, either by request or for those V&E records deleted from the VEF. See flowchart in Figure VII.5.

2. Inputs

- The PWS Table.
- File identifier, indicating whether the module is to process history records or deleted V&E records.
- An intermediate file containing V&E records selected for this report prepared by module VAEX040.
- An intermediate file containing V&E records deleted from the VEF, prepared by module VAEX010.
- The VEF.

3. Output - Report VAEX040R - Variances and Exemptions Case History (Exhibit III.31).

4. Process

- The file identifier card is read.
- The appropriate V&E file is read. If this is the selections file, then the first record contains sort parameters, and the file is sorted accordingly.
- Records are read, additional information retrieved from the PWS Table, and the report printed.

VIII. THE SANITARY SURVEY SUBSYSTEM

A. Overview and Purpose

Section 142.10(b)(2) of the Drinking Water Standards Implementation Regulations, requires that states with primary enforcement responsibility will have "A systematic program for conducting sanitary surveys of public water systems not in compliance. . ."

A survey of 24 states shows that many states do not have enough manpower to survey public water systems as often as they would like. The addition of non-community PWS's to those already under regulation, will increase the necessity for a systematic method of scheduling sanitary surveys. The Sanitary Survey Subsystem is designed to provide this systematic method.

The method is based on assigning different weights to four parameters: PWS type, size of population served, compliance history, and period elapsed since last survey. State officials can change the relative weights until a satisfactory formula is reached that can be used to schedule PWSs for survey. This is achieved by two modules: SRVY010 which is used to try out different weights, and SRVY020 for the actual scheduling.

The features of the subsystem are:

- Simple, off-line batch processing;
- Survey form designed as a turnaround document for computer input processing;
- Interaction with the PWS Inventory Subsystem.
- Subsystem is optional.

The benefits that may be realized by implementing the subsystem are:

- Consistent selection process according to standard criteria.
- Simplifying the surveying process by generating preprinted forms with current PWS data.
- Efficient use of engineering manpower by assisting state program managers in allocating scarce manpower according to objective standard priorities.

B. Selection for Survey - Module SRVYØ1Ø

1. Function

- To accept selection criteria, compute the selection key for every PWS, sort the PWS records by value of selection key and list SRVYØ1ØR - PWS by Priority for Sanitary Survey.
- Optionally, an intermediate file is created containing records with higher priority for survey according to surveying capacity.
- Figure VIII.1 contains the flowchart of the selection process.

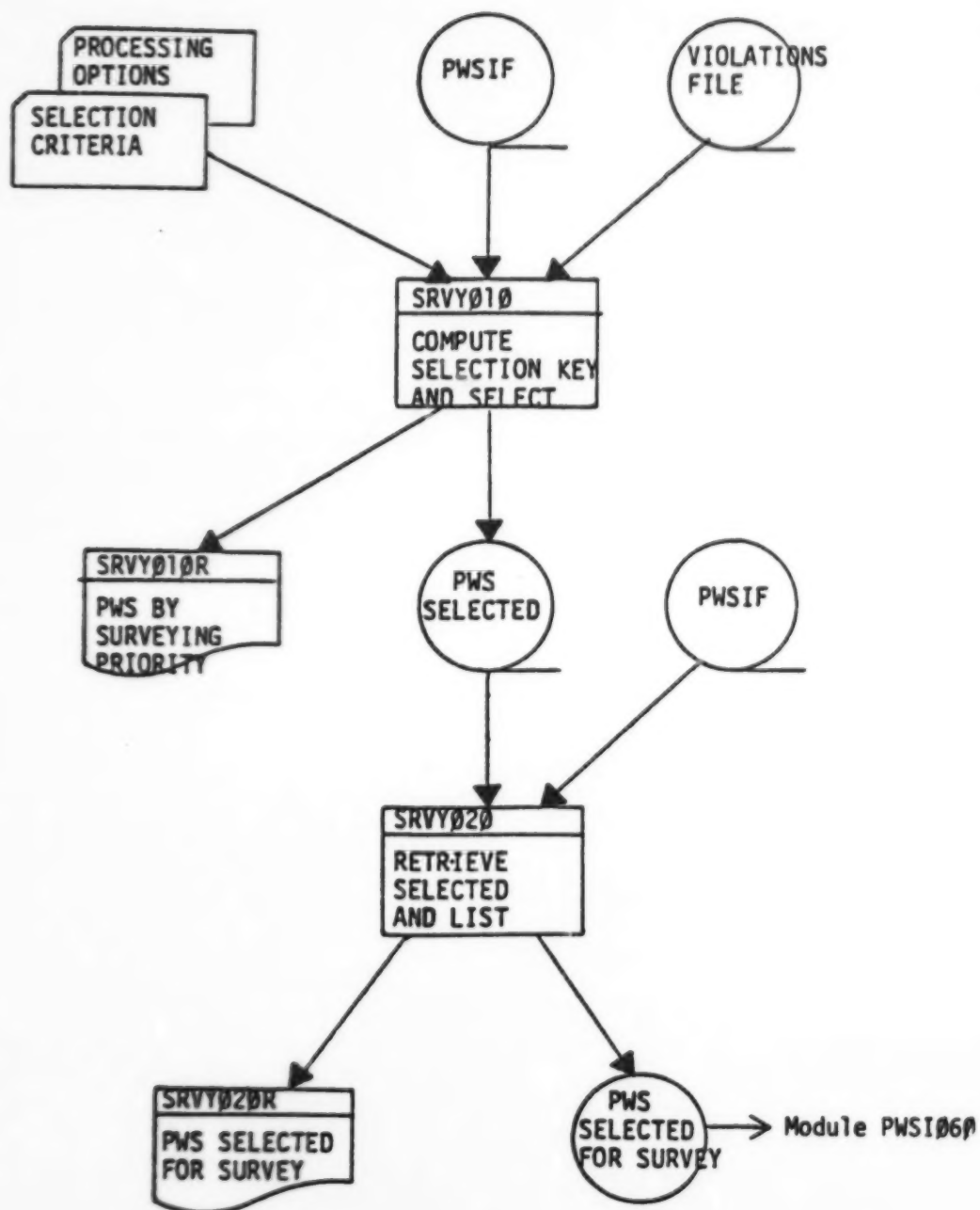
2. Inputs

- Processing options, which are the sort parameters for report SRVYØ1ØR, and an indicator whether an actual PWS selection is required.
- Selection criteria, containing the weights assigned to each of the selection parameters: PWS type, size of population served, period elapsed since last sanitary survey and record of compliance. Also included is the selection cutoff number - the capacity for surveys.
- The PWSIF.
- The Violations File.

3. Outputs

- Report SRVYØ1ØR - Public Water Systems by Priority for Sanitary Survey (Exhibit III.32).
- An intermediate file containing PWS record that were selected for survey.

FIGURE VIII.1
PWS SURVEY SELECTION



4. Process

- Selection criteria and processing options are read and verified. If a sort by region and district is requested, there must be a capacity factor for each region or district.
- Records are read from the PWSIF and matched with corresponding violations from the Violations File.
- The survey priority key is computed by applying the selection weights to the selection parameters.
- A record is written to a work file containing data elements required for report SRVYØ1ØR, the selection key and a sort key.
- When the PWSIF is exhausted, the work file is sorted by sort key and selection key.
- The sorted records are read and used to print report SRVYØ1ØR.
- If the option to select PWSs for survey is elected, the top PWS records for each district or region according to capacity are written on the intermediate file. Each record on that file is similar to the records from the sorted work file except the first record which contains the selections criteria and sort parameters.

1. Function

- To retrieve selected PWS records from the PWSIF and generate an intermediate file for producing PWS Comprehensive List;
- To list report SRVY020R - PWS Scheduled for Sanitary Survey. See flowchart in Figure VIII.1.

2. Inputs

- The PWSIF.
- An intermediate file prepared by module SRVY010 containing a record for every PWS that has been selected for survey. The first record on the file contains the sort parameters and selection weights.

3. Outputs

- An intermediate file containing PWS records. This file will be used by Module PWSI060 - to list a comprehensive report for every PWS.
- Report SRVY020R - Public Water Systems Scheduled for Sanitary Survey (Exhibit III.33).

4. Process

- The options and selection criteria are read from the intermediate file.
- Records are read from the intermediate file and used to produce the report.
- The PWS-ID from each record is stored in an internal table.
- When all records are read, the internal table is sorted by PWS-ID.
- The PWSIF is scanned, and all PWS records which have their ID in the table are written to the output file.

D. Comprehensive PWS List

The intermediate file from Module SRVY020 is input to Module PSWI060 which is the standard module for PWS Comprehensive Listings (See flowchart in Figure II.3).

IX. THE ENFORCEMENT ACTIONS SUBSYSTEM

A. Overview and Purpose

The purpose of this subsystem is to provide the state with a method for collection, maintenance, and processing of data related to actions performed in connection with enforcing the state's own regulations under the Safe Drinking Water Act or the Federal Regulations. These data can then be used for evaluating the effectiveness of different types of enforcement actions. The subsystem has the following features:

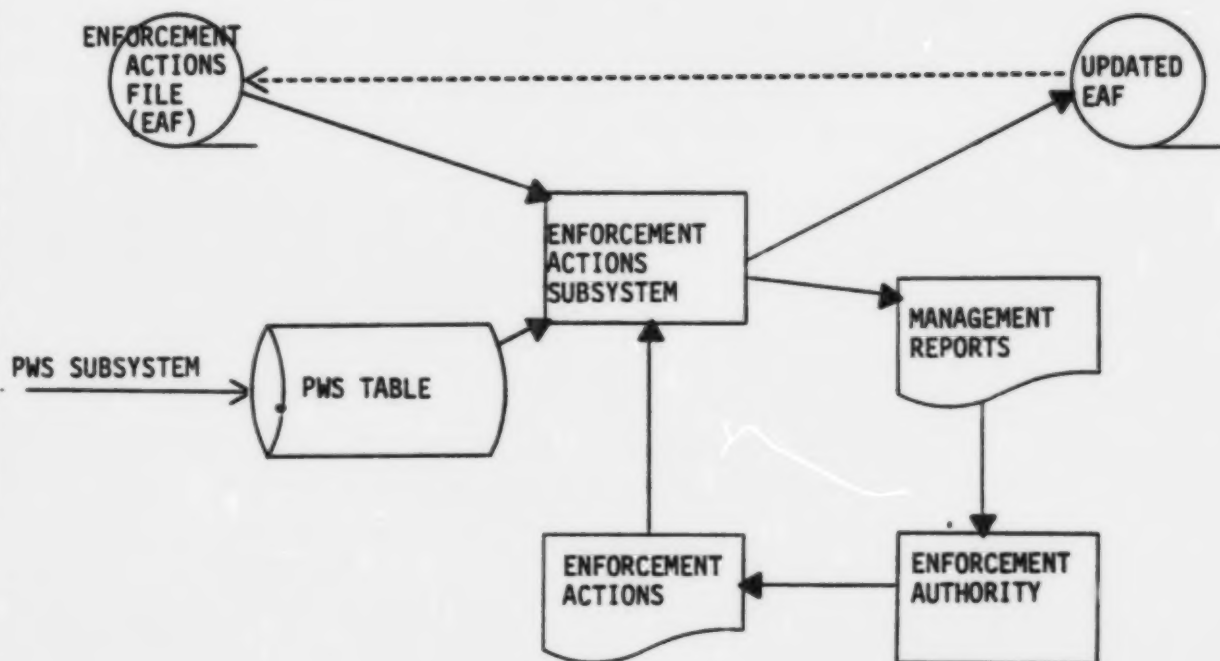
- Some flexibility in preparing reports with respect to selection criteria and sorting;
- Subsystem is optional;
- Off-line batch processing using sequential files.

The main benefit resulting from implementing the subsystem is the maintenance of enforcement actions in a format that will facilitate analysis of enforcement data and enforcement history. This analysis can help states to evaluate the effectiveness of various actions for enforcing the Safe Drinking Water Act.

Reporting to EPA of enforcement actions, as required by Section 142.15 of the regulations, can also be done automatically using the subsystem by submitting to EPA the reports of the entire Enforcement Actions File. See subsystem flowchart in Figure IX.1.

FIGURE XI.1
THE ENFORCEMENT ACTIONS SUBSYSTEM

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Transactions to create and maintain records in the Enforcement Actions File (EAF) are in the 80 column format of the punched card. The source of transactions is the administrative unit responsible for enforcing the drinking water regulations by formal actions.

A five-digit sequential number is used to identify an enforcement action record. This number in columns 1 to 5 of a transaction and the transaction code in columns 6 and 7 constitute the transaction key.

There are four types of transactions: addition of a new record, changes to data elements in an existing record, case history request, and deletions (Exhibit I.5).

1. Addition of a New Record - Transaction Code '00'

This transaction contains only an enforcement action identification number and transaction code. It causes creation of an enforcement action record without data. All other data elements are added as if they represent changes.

2. Change Transactions

A series of transaction codes are used to modify different sets of data elements:

Transaction Code '01' - used to change the value of:

- Action legal reference
- Action name
- Action date
- Legal status code
- Case open or closed indicator
- PWS identification

Transaction Code '02' - used to change the value of:

- Plaintiff type code
- Plaintiff name

Transaction Code '03' - used to change the value of:

- Defendant type code
- Defendant name

Transaction Codes '04' and '05' - used to enter and change data on violations. For every violation (up to 10), the data elements are:

- Violation code
- Violation date
- Contaminant-ID, if applicable

Transaction Code '06' - used to enter or change the consent order number and date, and the permit number and date.

Transaction Codes '07', '08', '09', '10' and '11' are used to change the values of lines 1 to 10 of the case abstract (2 lines per transaction).

Transaction Code '12' - used to create or change data elements relating to a milestone. A milestone is identified by its target date, and contains two more data elements:

- Milestone code
- Actual date

Transaction Code '18' - used to delete a milestone reference from the enforcement action record.

3. Case History Request - Transaction Code '98'

This transaction causes the enforcement action record to be written to a file which later serves as input to Module ENAC030 - Case History Listing.

4. Deletion of a Record - Transaction Code '99'

This transaction causes deletion of an enforcement action record from the EAF.

C. Data Entry and Updating - Module ENAC010

1. Function

- To accept input transactions into the Enforcement Actions Subsystem.
- To validate the transactions and update the EAF.
- Individual states would establish their processing schedules for this module; for example, it may be run monthly or bi-weekly, depending on the amount of data waiting for process. Figure X1.2 contains a flowchart of Data Entry and Updating.

2. Inputs

- The EAF.
- Input transactions as described above, including corrections of errors that occurred in previous runs.
- The PWS Table.

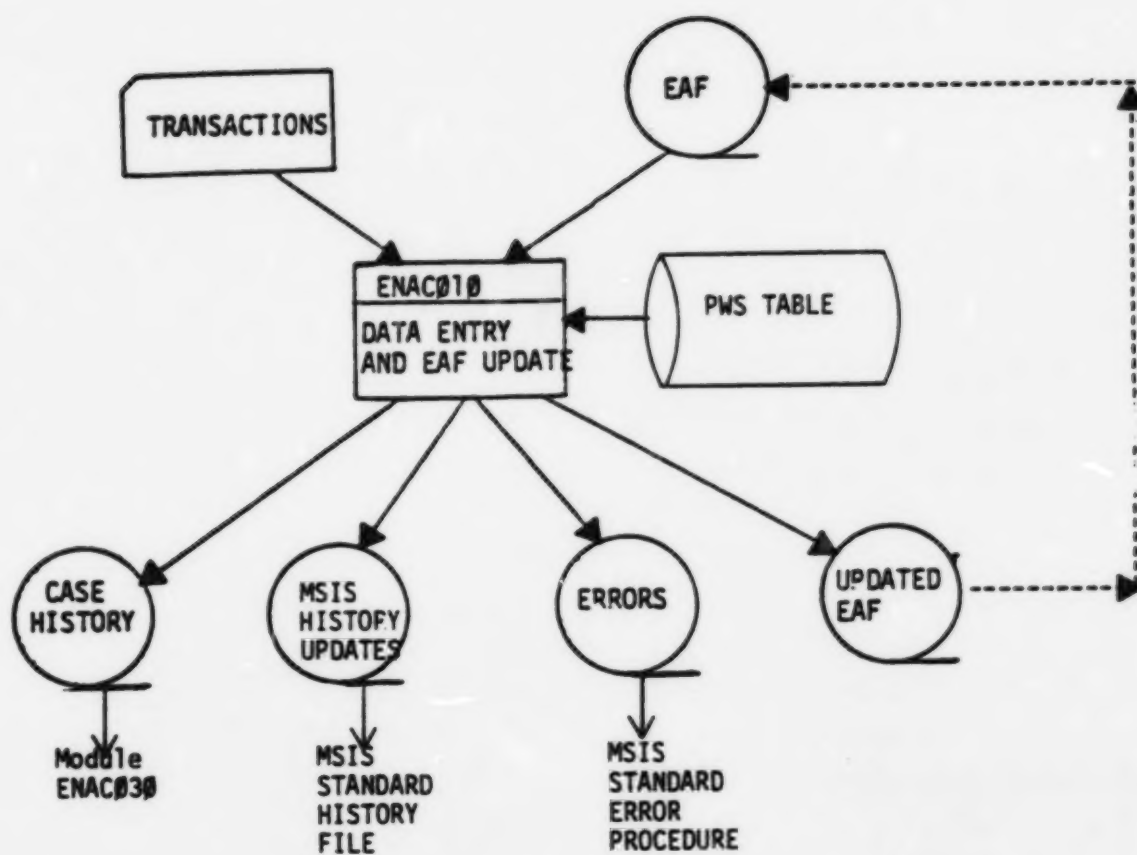
3. Outputs

- An updated version of the EAF
- An intermediate file containing error transactions to be processed by the MSIS standard error handling process.
- An intermediate file containing records for printing the update report by the MSIS standard process;
- An intermediate file containing enforcement action records for case history listing by Module ENAC030.

4. Process

- Transactions are sorted by enforcement action identification and transaction code.
- All transactions are checked for validity of their data elements. If transaction is invalid, it is written on the errors file.

FIGURE XI.2
DATA ENTRY AND UPDATING



- Valid transactions are matched against the EAF:
 - If transaction is an addition and an enforcement action record already exists - the transaction is written on the errors file.
 - If transaction is an addition, and a corresponding record does not exist, an enforcement action record is created;
 - All other transactions are in error if a corresponding enforcement action record does not exist, and are written on the errors file.
 - If a record exists, then the change of values or a deletion takes place. A record is written to the MSIS History update file for every data element that its value was changed, unless the enforcement action record was created at that run.
 - If the transaction is a request for case history, the corresponding enforcement action record is written on the case history file, with an identifying flag prefixed to it.
 - If the transaction is a deletion, the enforcement action record is deleted, and an appropriate record is written to the MSIS History updates file.
- All new records are written on the case history file with an identifying flag prefixed to each record.

D. Enforcement Action Records Selection - Module ENAC020

1. Function

- To scan the EAF and select enforcement action records to be printed in a case history report or condensed list.

Figure X1.3 contains the flowchart of the selection and reporting process.

2. Inputs

- Selection cards in the same format as explained in Section II.E
- The EAF
- PWS Table

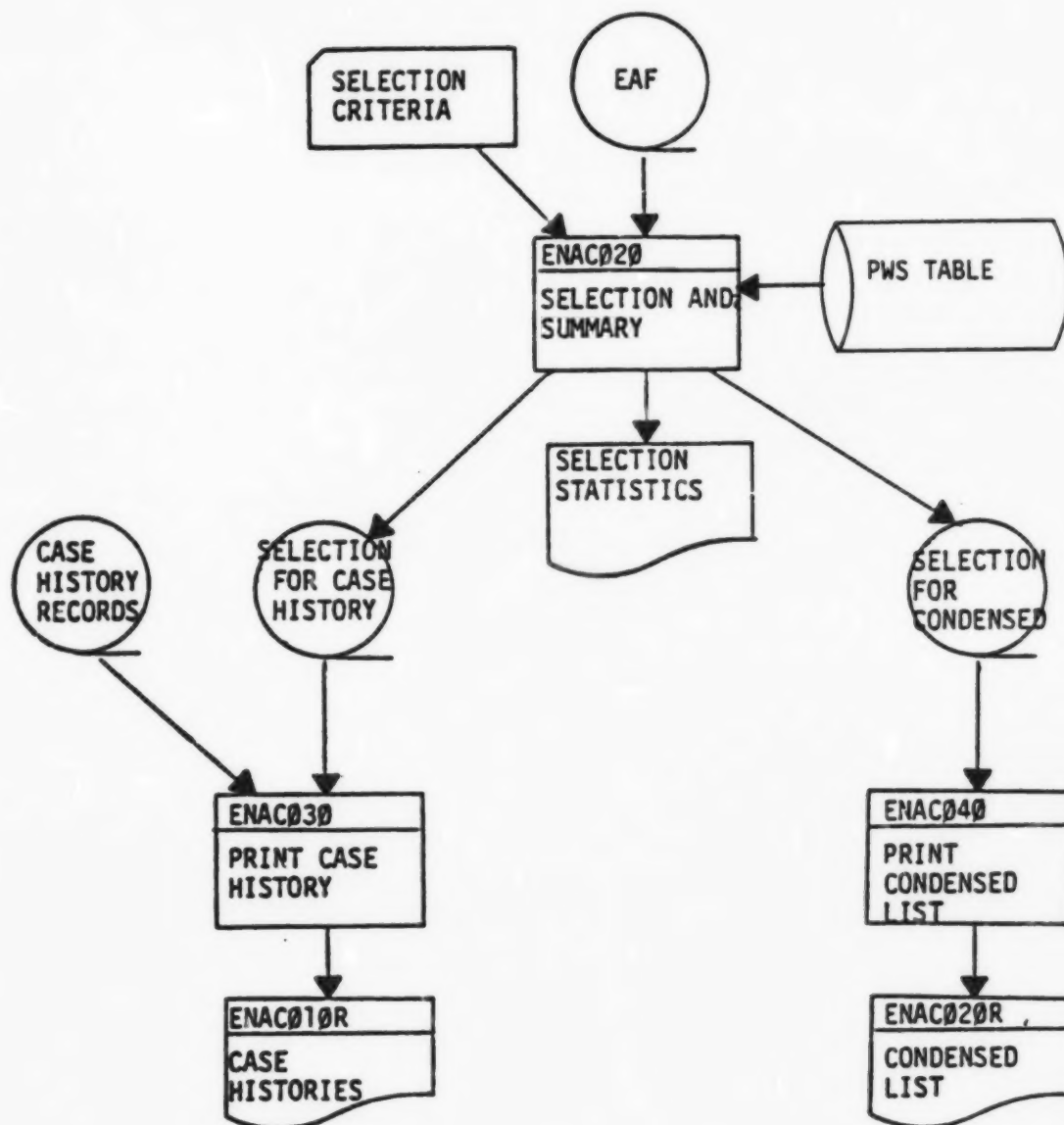
3. Outputs

- An intermediate file containing records selected for case history print
- An intermediate file containing records selected for condensed listing
- Selection statistics, showing selection parameters for each file, and the number of records selected (report will be designed during the detail design phase).

4. Process

- Selection cards are read and verified. An internal table is constructed for selections
- Each EAF record is examined against the selection criteria for all three reports
- If a record fits the selection criteria for any of the reports, then:
 - If the report is the case history file, the record is written on the case history file with an identifying flag prefixed to it.

FIGURE X1 3
ENFORCEMENT ACTIONS RECORDS SELECTION AND REPORTING



- If the report is the condensed list, a record containing the needed information is written on the intermediate file.
- If the record fits the selection criteria for the summary table, the appropriate information is summarized in the internal tables.
- At completion of EAF scanning, the selection criteria are printed together with count of records selected.
- The first record on the condensed list file contains the sort parameters for the report.

E. Enforcement Action Case History Listing - Module ENAC030

1. Function

- To print report ENAC010R - Enforcement Action Case History. See flowchart in Figure X1.3.

2. Inputs

- An intermediate file created by Module ENAC010 and containing records for case history listing. These are either new records or those requested for case history. Records are identified by a flag prefixed to each.
- An intermediate file created by Module ENAC020, containing records selected for case history list.

3. Output

- Report ENAC010R - Enforcement Action Case History (Exhibit III.34).

4. Process

- The records on the intermediate file from the updating process are sorted according to the record type (new or requested)
- Sorted records are listed
- Records are read from the intermediate file from the selection process file, and listed.

F. Enforcement Actions Condensed Listing - Module ENAC040

1. Function

- To sort the intermediate file created by the selection module and list report ENAC020R - List of Enforcement Action Cases. See flowchart in Figure X1.3.

2. Input

An intermediate file created by the selection module ENAC020.

3. Output

Report ENAC020R - List of Enforcement Actions Cases (Exhibit III.35).

4. Process

- The first record on the input file contains sort parameters. The record is read and then the rest of the file is sorted according to the specified parameters.
- Sorted records are read and listed.

X. THE OPERATOR AND MAILING SUBSYSTEM

A. Overview and Purpose

The Operator and Mailing Subsystem is designed for two purposes: first, to provide management with data concerning certified operators, and second, to provide the state with the capability to manage a mailing distribution list for mailing material to local governments, cities, consulting engineers, etc. Since the mailing list and operator data requirements are similar, these two functions are combined in a single subsystem.

The subsystem features an off-line, sequential processing of a variable length record file, and its main benefits are:

- Provides a means of managing certified operator data, including renewal of certificates and class scheduling.
- Facilitates preparation of mailing labels, sorted by zip code (so that the sorted mail may use bulk postal rates).

The subsystem comprises two major processes: the data input and file maintenance process, and the selection and reporting process. The Data Entry and Update module (OPER010) addresses the first process; and the selection and reporting process consists of a selection module (OPER020) and a series of reporting modules. These processes and their respective modules are described below.

B. Input Transactions

Transactions to maintain the Mailing File are in the 80 column format of the punched card. There are three types of transactions: add a new record, change data elements in an existing record, and deletion of a record. Records are identified by a five-digit sequential number and an addressee type code.

Addressee type '0' is reserved for operators. Other addressee types are left to be defined by each state according to its needs.

Because an operator record contains more information than another addressee type record, there are two different input forms for the two types (see Exhibits I.7 and I.8). The difference between the two is that transaction '03' applies only to operator records.

The five major types of transactions processed by this subsystem are described below.

Transaction Code '00' - used to add a new address record. An empty record will be created, and other data elements added as changes.

Transaction Code '01' - used to change the value of the following data elements:

- Addressee Type.
- Addressee Name;
- Address line 1.

Transaction Code '02' - used to change the value of:

- Address line 2;
- State;
- Zip Code;
- Telephone number (optional).

Transaction Code '03' - used to change the value of:

- Certificate Number;
- PWS-ID (where the operator is employed);
- The six (A to F) certification classes;
- Certificate renewal date.

Transaction Code '09' - used to delete a record.

C. Data Entry and Update - Module OPER010

1. Function

- To accept input transactions into the Operator and Mailing Subsystem, to validate them and update the Operator and Mail File (OMF) from the transactions. See flowchart in Figure X.1.

2. Inputs

- Input transactions.
- The Operator and Mail File (OMF).
- The PWS Table (as a verification aid).

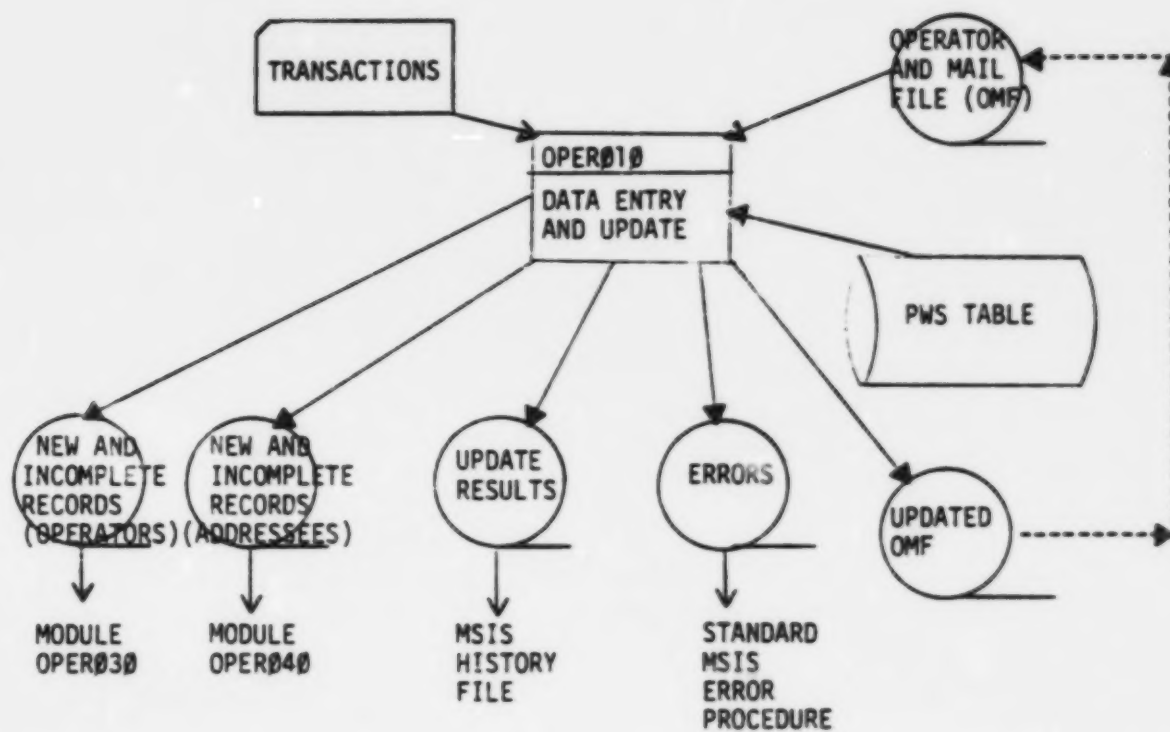
3. Outputs

- An updated version of the OMF.
- Error File to be processed by MSIS standard error procedure.
- Update results file, to produce the update report and update the MSIS History File.
- Two intermediate files containing new and incomplete records. One contains records for operators, to be processed by module OPER030. The other, records of other addressees to be processed by module OPER040.

4. Process

- Transactions are sorted by addressee type and sequential number.
- Transactions are validated, if a data element is invalid, a record is written on the errors file.
- Transactions are matched against the OMF:
 - If transaction is an addition and a corresponding record exists, the transaction is in error and is written on the errors file.
 - If transaction is an addition and a matching record does not exist, a new record is created.
 - A record must exist for any other transactions. Otherwise, the transaction is in error and is written to the errors file.
 - If a matching record exists, the change of values or deletion takes place, including writing a record on the update MSIS history update file.

FIGURE X.1
DATA ENTRY AND UPDATE



- Transaction type '03' is allowed only for an operator record; otherwise it is in error.
- New records are written to the appropriate intermediate file.
- Every record is checked to verify that a name, at least one address line, state, and zip code are present. If not, it is incomplete and is written to the appropriate intermediate file.
- Transaction type '09' causes a deletion of the record and writing an appropriate record to MSIS History update file to denote the deletion.

D. The Selection and Reporting Process

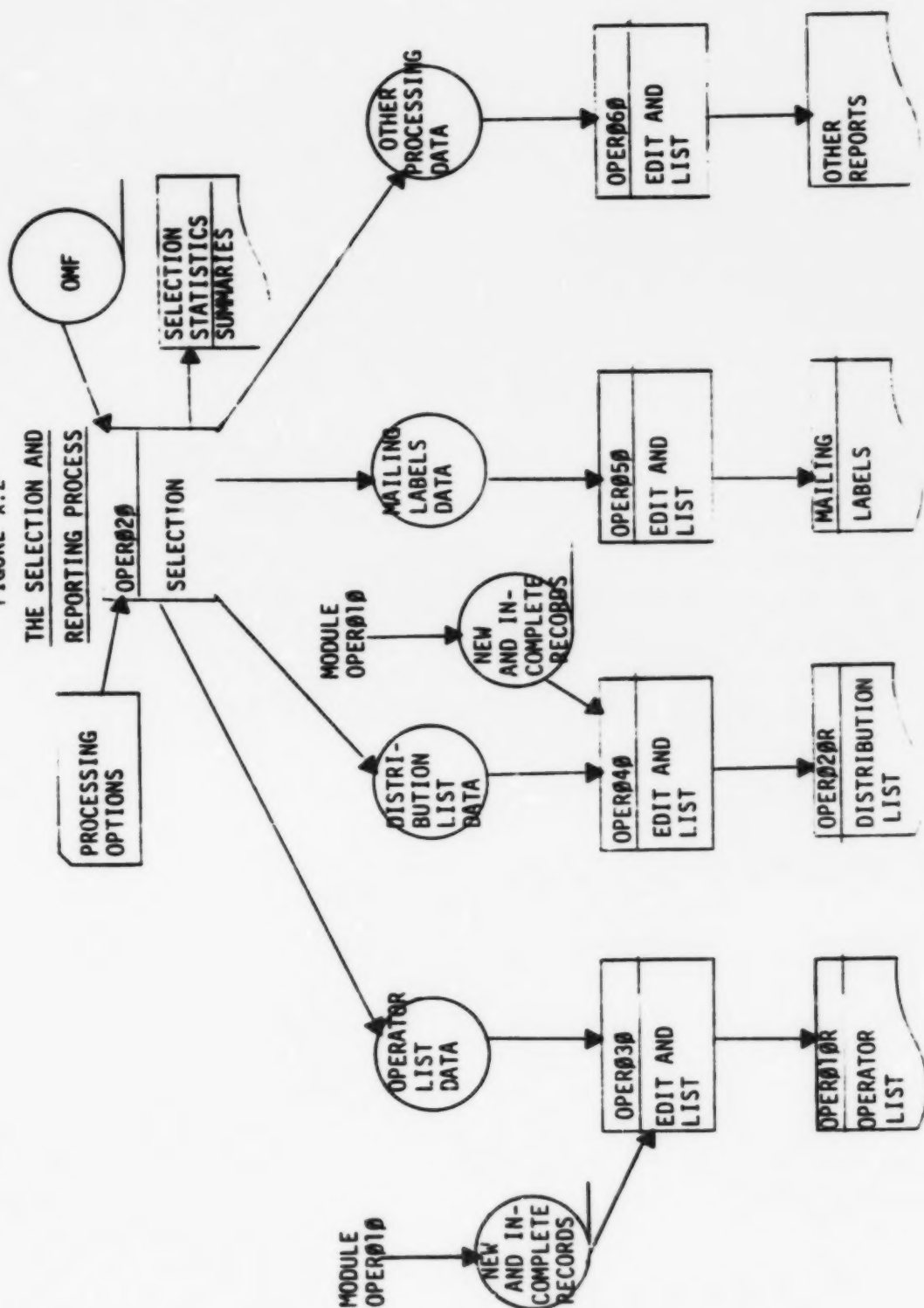
1. Overview

The selection and reporting process utilizes the MSIS selection language (see Section II.C) to select various operator and addressee records from the OMF. Four basic reports can be selected.

- a. A distribution list of non-operator addressees.
- b. A list of certified operators.
- c. Mailing labels.
- d. Other reports, such as operator certification cards.
These other reports have not been designed because of the diversity between state certification procedures. This process extracts the required data from the OMF and individual states must develop their own print routines.

A state can use the first two reports for displaying all or a selected group of records in various sorts. For example, both reports can be used as a quick reference list in alphabetical order; another application would be to schedule training classes by selecting all operator records which have a certificate renewal date prior to a specified date and whose zip code is between a specified range. The process consists of five modules: a selection module (OPER020), and four reporting modules. See the flowchart of the selection process in Figure X.2.

FIGURE X.2
THE SELECTION AND
REPORTING PROCESS



2. The Selection Module - OPER020

a. Function

- To scan the Operator and Mailing File (OMF) and select records to be listed to four output files. See flowchart in Figure X.2.

b. Inputs

- Processing options, specifying which of the optional four output files to generate, and sort and selection criteria for each output. (See Section II.C for a description of MSIS selection language.)
- The Operator and Mailing File (OMF).

c. Outputs

- Four intermediate files containing records from the OMF which were selected for subsequent listing. The first record on each of the files contains the sort option for the applicable report. The intermediate files contain data as follows:
 - Records to produce the Mailing Distribution Report.
 - Records to produce the Certified Operator List.
 - Records to produce Mailing Labels.
 - Records to produce Other, states own, reports.
- A report describing the selection criteria and the number of records selected for each report. (The layout to be designed during the detail design phase.)

d. Process

- Processing options are read and verified.
- On each of the required output files, the first record is written, containing sort options for the applicable report. The first record on the intermediate file for printing mailing labels contains also the number of labels to be printed from each record.
- The OMF is read. Each record is scanned to see if it meets the selection criteria for any of the reports in which care it is written to the applicable file.
- At the conclusion of the process, the selection summary is listed.

3. The Certified Operator List - Module OPER030

a. Function

- To list report OPER010R - Certified Operators List, from files prepared by the selection module (OPER020) or the update module (OPER010). See flowchart in Figure X.2.

b. Inputs

- An intermediate file prepared by the Data Entry and Update module (OPER010) containing new or incomplete operator records.
- An intermediate file prepared by the selection module (OPER020) containing records which were selected for listing. The first record on this file contains sort parameters.

c. Output

Report OPER010R - Certified Operator List (Exhibit III.36).

d. Process

- If the intermediate file from module OPER010 is input, all the records are read and listed.
- If the intermediate file from module OPER020 is input, the first record is read to obtain the sort parameters and then the other records from the file are sorted.
- The sorted file is read and each record listed.

4. The Mailing Distribution List - Module OPER040

a. Function

- To list report OPER020R - Mailing Distribution List, from files prepared by the selection module (OPER020) or the update module (OPER010). See flowchart in Figure X.2.

b. Inputs

- An intermediate file prepared by the data entry and update module (OPER010) containing new or incomplete addressee records other than operator records.
- An intermediate file prepared by the selection module (OPER020) containing records which were selected for listing. The first record on the file contains sort parameters.

c. Outputs

Report OPER020R - Mailing Distribution List (Exhibit III.37).

d. Process

- If the intermediate file from module OPER010 is input, it is read and all the records listed.
- If the intermediate file from module OPER020 is input, the first record is read to obtain the sort parameters, and then the other records are sorted.
- The sorted file is read and each record listed.

5. Mailing Labels Production - Module OPER050

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a. Function

- To produce mailing labels. See flowchart in Figure X.2.

b. Input

- An intermediate file prepared by the selection module (OPER020).
The first record contains sort parameters and the number of labels to be printed for each addressee.

c. Output

- Mailing labels in the standard format of one inch width with six lines (printed at eight lines per inch).

d. Process

- The first record is read from the intermediate file to obtain the sort parameters and the number of labels per addressee.
- The other records are sorted. If record does not contain sort parameters, then the sort is done by zip code.
- The sorted file is read and each record is used to list the required number of mailing labels.

6. Special Reports - Module OPER060

a. Function

- To produce state defined reports. See flowchart in Figure X.2.

b. Input

- An intermediate file prepared by the selection module (OPER020).
The first record on the file contains sort parameters.

c. Output

- State defined reports. In this design phase no other report has been identified other than those described above.

d. Process

- The process will be defined by states who elect to implement additional reports.

APPENDIX A
SUMMARY OF MAJOR CHANGES

This appendix summarizes major changes to the Model State Information System For The Safe Drinking Water Act, Definition of System Requirements, January 12, 1976. This January 12 design set the base for a model state information system and was used as a discussion document during our site visits to 24 states, EPA regional offices, and EPA headquarters. These visits were extremely useful in enabling the states to provide inputs regarding their requirements. Thus, the comments and suggestions received from the states, regional offices, and the February 18, 1976 meeting at EPA resulted in modifications to the system requirements, which modifications are reflected in this design.

One major finding of the states survey is that most of the states drinking water supply units have access to a large computer facility, in contrast to our former assumption that a typical ADP environment is a medium size computer, e.g., an IBM/360 model 40. The two main limitations imposed by this assumption were the lack of spooling and scarcity of direct access storage. The general design as revised in this document continues to utilize a modular design approach for each major function.

The advantage of this approach is that it allows us to identify the functions of each module and simplifies the computation of development and operation costs for each process. However, an important task of the detailed design phase should be to structure the interfaces among modules to ensure maximum operating efficiency.

Major changes in each subsystem are discussed below:

1. The PWS Inventory Subsystem

The main change is in the contents of the PWS record of the PWS Inventory File (PWSIF). It includes the enlargement of the PWS identification number from five to seven positions, thus allowing the states to structure the number. The Federal-ID number is dropped and a PWS will be identified in EPA systems by a combination of PWS-ID, and state code.

Secondly, data elements have been added to the record; for example, laboratory identification, a code to identify an Indian reservation, a flag to identify an interstate carrier, monthly operation report requirement and date.

2. The Water Quality Compliance Subsystem

This is the central subsystem of MSIS and, as expected, received the most attention. Almost all the reports have been modified. The so-called early warning process has been eliminated because the MSIS does not operate on real time and a telephone call from a laboratory is probably a more effective method to accomplish the same objective. The Laboratory Workload Projection Report was also eliminated because the Laboratory Subsystem had been dropped from MSIS.

The maintenance of the Violation File was moved to this subsystem as a recurring, periodic process to facilitate the production of a meaningful compliance report.

Another significant change is the addition of compliance monitoring with respect to the monthly operation report that many PWSs are required to submit each month. The MSIS monitors only the submission of the report and not its contents.

The sample scheduling process was redefined including a redesign of the formats of all turnaround documents.

3. The Federal Reporting Subsystem

The maintenance of the Violation File was removed from this subsystem and included in the Water Quality Compliance Subsystem. Copying the Enforcement Actions File was added because enforcement information must be reported to EPA.

4. The Laboratory Subsystem

This subsystem is no longer a part of MSIS as an automated function. The survey of states shows that the number of laboratories does not justify the automation of an inventory subsystem. The reports, however, are still included in Volume II of this document, as recommended reports to be prepared either manually or through a state developed computer system.

The Laboratory Table is still required for data validation purposes, and is included in the Inventory Subsystem.

5. The Operator and Mailing Subsystem

The Mailing Subsystem was extended to facilitate the maintenance of data on certified operators.

The automated updating of PWS addresses is not performed in this subsystem because the printing of mailing labels is done directly from the PWSIF. The removal of the Laboratory Subsystem results also in the removal of the automatic updating of their addresses.

APPENDIX BTHE PWS INVENTORY FILE CONVERSION

MSIS implementation costs may be reduced significantly if EPA can provide the states with a baseline PWS Inventory File. This can be done by converting the National PWS Inventory File into the format of the PWSIF for each state. Many data elements that are present on a PWS record in the PWSIF are also present on a PWS in the National PWS Inventory File (which contains more than 77,000 records as of January 1, 1976).

Thus, an important part of the MSIS implementation process will be to list the initial PWSIF (converted from the National Inventory File) so that state personnel will be reviewing and correcting data originally supplied to EPA instead of re-inputting all that data.

A key problem in this approach is the assignment of PWS identification numbers. During the conversion of the files, the conversion program could assign a unique state code and identification number to every PWS record it creates. The simplest way this can be done is on a sequential basis. This arbitrarily assigned identification number may suit some states, but other states may wish to create meaningful identification numbers by using a one-time program to change the PWS-ID and sort the PWSIF by the new sequence.

Once the initial PWS inventory file is established in a state, new ID numbers can be assigned by the state; this should cause no problem to the EPA system which uses a combined state code and PWS-ID as the unique identifier.